

Document Control No. 4400-48-AIFC

Revision 1

ECOLOGICAL RISK ASSESSMENT FOR
TENNESSEE PRODUCTS SITE
CHATTANOOGA, TENNESSEE

Work Assignment No. 48-4LBV

APRIL 1999

REGION IV

U.S. EPA CONTRACT NO. 68-W9-0057

Roy F. Weston, Inc.
Suite 200
5405 Metric Place
Norcross, Georgia 30092

WESTON W.O. No. 04400-048-093-0015-09

**ECOLOGICAL RISK ASSESSMENT
TENNESSEE PRODUCTS SITE**

REVISION 1

CHATTANOOGA, TENNESSEE

U.S. EPA Contract No. 68-W9-0057

Work Assignment No. 48-4LBV

Document Control No. 4400-48-AIFC

APRIL 1999

Prepared by: _____



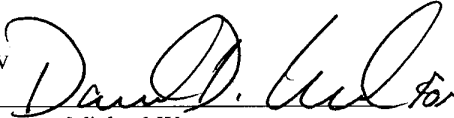
David Nelson, P.E.
WESTON Work Assignment Manager

Date: _____

4/14/99

Technical Review

Performed by: _____

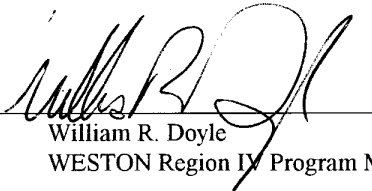


Michael Werner
Senior Project Scientist

Date: _____

4/14/99

Approved by: _____



William R. Doyle
WESTON Region IX Program Manager

Date: _____

4-14-99

Approved by: _____

Nestor Young
U.S. EPA Remedial Project Manager

Date: _____

Approved by: _____

Robert P. Stern
U.S. EPA Regional Project Officer

Date: _____

WESTON W.O. No. 04400-048-093-0015-09

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
1	INTRODUCTION	1-1
1.1	Site Background	1-1
1.2	Previous Site Investigations	1-4
1.3	Risk Assessment Objectives and Guidance	1-6
2	PROBLEM FORMULATION	2-1
2.1	Data Evaluation and Reduction	2-1
2.1.1	Introduction	2-1
2.1.2	Guidelines for Data Reduction	2-2
2.1.3	Soil Sampling Results	2-5
2.1.4	Surface Water Sampling Results	2-10
2.1.5	Sediment Sampling Results	2-10
2.1.6	Clam Tissue Sampling Results	2-10
2.1.7	Selection of Chemicals of Potential Concern	2-16
2.2	Selection of Chemicals of Potential Concern	2-17
2.2.1	Early Successional/Ruderal Community	2-18
2.2.2	Clearcut Wetland Community	2-21
2.2.3	Riparian Forest Community	2-23
2.3	Identification of Exposure Pathways	2-25
2.3.1	Surface Water/Sediment	2-26
2.3.2	Soil	2-26
2.3.3	Groundwater	2-27
2.4	Selection of Assessment and Measurement Endpoints	2-27
2.5	Site Conceptual Model	2-30
2.5.1	Aquatic Habitat	2-30
2.5.2	Terrestrial Habitat	2-33

TABLE OF CONTENTS (Continued)

<u>Section</u>	<u>Title</u>	<u>Page</u>
3	EXPOSURE CHARACTERIZATION	3-1
3.1	Selection of Indicator Special/Communities and Pathways of Exposure	3-1
3.1.1	Aquatic Life	3-3
3.1.2	Terrestrial Wildlife	3-3
3.1.3	Terrestrial Vegetation	3-6
3.1.4	Soil Invertebrates	3-6
3.1.5	Endangered and Threatened Species	3-7
3.1.6	Summary	3-7
3.2	Exposure Concentrations	3-7
3.3	Estimation of Exposure Doses	3-16
3.3.1	Northern Short-Tailed Shrew	3-16
3.3.2	White-Footed Mouse	3-20
3.3.3	American Robin	3-25
3.3.4	Muskrat	3-31
4	ECOLOGICAL EFFECTS CHARACTERIZATION	4-1
4.1	Toxicity to Aquatic Life	4-1
4.1.1	Surface Water	4-1
4.1.2	Sediment	4-2
4.2	Toxicity to Terrestrial Wildlife	4-6
4.3	Toxicity to Terrestrial Vegetation	4-11
4.4	Toxicity to Soil Invertebrates	4-26

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Table of Contents
Revision: 1
Date: April 1999

TABLE OF CONTENTS (Continued)

<u>Section</u>	<u>Title</u>	<u>Page</u>
5	RISK CHARACTERIZATION	5-1
5.1	General Approach	5-1
5.2	Risk Characterization to Aquatic Life	5-3
5.2.1	Surface Water	5-3
5.2.2	Sediment	5-6
5.2.3	Aquatic Life Risk Summary	5-11
5.3	Risk Characterization for Terrestrial Wildlife	5-13
5.3.1	Northern Short-Tailed Shrew	5-13
5.3.2	White-Footed Mouse	5-16
5.3.3	American Robin	5-19
5.3.4	Muskrat	5-22
5.4	Risk Characterization for Terrestrial Vegetation	5-23
5.5	Risk Characterization for Soil Invertebrates	5-31
6	UNCERTAINTY ANALYSIS	6-1
6.1	Aquatic Life	6-3
6.2	Northern Short-Tailed Shrew	6-4
6.3	White-Footed Mouse	6-10
6.4	American Robin	6-12
6.5	Muskrat	6-14
6.6	Terrestrial Vegetation	6-16
6.7	Soil Invertebrates	6-17

TABLE OF CONTENTS (Continued)

<u>Section</u>	<u>Title</u>	<u>Page</u>
7	CONCLUSIONS	7-1
7.1	Results of the Ecological Risk Assessment	7-1
7.2	Results of the Sediment Toxicity and Bioaccumulation Studies . . .	7-4
8	REFERENCES	8-1

LIST OF APPENDICES

APPENDIX A - Environmental Media Data

APPENDIX B - Flora and Fauna Observed at the Tennessee Products Site

APPENDIX C - Calculation of Chemical Concentrations in Earthworms

APPENDIX D - Calculation of Chemical Concentrations in Plant Seeds

APPENDIX E - Supplemental Investigation for the Ecological Risk Assessment

LIST OF FIGURES

<u>Figure No.</u>	<u>Title</u>	<u>Page</u>
1-1	General Site Location Map	1-2
1-2	Site Location Map	1-3
2-1	Soil, Sediment, and Clam Tissue Collection Location, December 1994 and May 1995	2-3
2-2	Upstream Sample (Control) Reach, December 1994 and May 1995	2-11

TABLE OF CONTENTS (Continued)

LIST OF FIGURES (Continued)

<u>Figure No.</u>	<u>Title</u>	<u>Page</u>
2-3	Habitat Map	2-19
2-4	Site Conceptual Model for the Aquatic Ecosystem	2-31
2-5	Site Conceptual Model for the Terrestrial Ecosystem	2-32

LIST OF TABLES

<u>Table No.</u>	<u>Title</u>	<u>Page</u>
2-1	Data Summary for Chemicals Detected in Tar Dump Soil (0 to 0.5 foot) .	2-6
2-2	Data Summary for Chemicals Detected in Tar Dump Soil (0 to 2 feet) . . .	2-7
2-3	Data Summary for Chemicals Detected in Hamill Road Dump #3 (0 to 0.5 foot)	2-8
2-4	Data Summary for Chemicals Detected in Hamill Road Dump #3 (0 to 2 feet)	2-9
2-5	Data Summary for Chemicals Detected in Chattanooga Creek Surface Water	2-12
2-6	Data Summary for Chemicals Detected in Chattanooga Creek Sediment	2-13
2-7	Data Summary for Chemicals Detected in Clam Tissue	2-15
2-8	Ecological Assessment and Measurement Endpoints	2-29
3-1	Exposure Routes of Potential Concern to Ecological Receptors	3-8

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Table of Contents
Revision: 1
Date: April 1999

TABLE OF CONTENTS (Continued)

LIST OF TABLES (Continued)

<u>Table No.</u>	<u>Title</u>	<u>Page</u>
3-2	Exposure Point Concentrations for Chemicals of Potential Concern Detected in Tar Dump Soil (0 to 0.5 foot)	3-11
3-3	Exposure Point Concentrations for Chemicals of Potential Concern Detected in Tar Dump Soil (0 to 2 feet)	3-12
3-4	Exposure Point Concentrations for Chemicals of Potential Concern Detected in Hamill Road Dump #3 Soil (0 to 0.5 foot)	3-13
3-5	Exposure Point Concentrations for Chemicals of Potential Concern Detected in Hamill Road Dump #3 Soil (0 to 2 feet)	3-14
3-6	Exposure Point Concentrations for Chemicals of Potential Concern Detected in Chattanooga Creek Surface Water	3-15
3-7	Exposure Point Concentrations for Chemicals Detected in Clam Tissue .	3-18
3-8	Model for Estimating Daily Intake by a Short-Tailed Shrew	3-21
3-9	Estimated Daily Intake of Chemicals of Potential Concern, Northern Short-Tailed Shrew, Tar Dump	3-22
3-10	Estimated Daily Intake of Chemicals of Potential Concern, Northern Short-Tailed Shrew, Hamill Road Dump #3	3-23
3-11	Model for Estimating Daily Intake by a White-Footed Mouse	3-26
3-12	Estimated Daily Intake of Chemicals of Potential Concern, White-Footed Mouse, Tar Dump	3-27
3-13	Estimated Daily Intake of Chemicals of Potential Concern, White-Footed Mouse, Hamill Road Dump #3	3-29

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Table of Contents
Revision: 1
Date: April 1999

TABLE OF CONTENTS (Continued)

LIST OF TABLES (Continued)

<u>Table No.</u>	<u>Title</u>	<u>Page</u>
3-14	Model for Estimating Daily Intake by an American Robin	3-32
3-15	Estimated Daily Intake of Chemicals of Potential Concern, American Robin, Tar Dump	3-33
3-16	Estimated Daily Intake of Chemicals of Potential Concern, American Robin, Hamill Road Dump #3	3-35
3-17	Model for Estimating Daily Intake by a Muskrat	3-37
3-18	Estimated Daily Intake of Chemicals of Potential Concern, Muskrat Chattanooga Creek	3-38
4-1	EPA Region 4 Freshwater Surface Water Screening Values	4-3
4-2	Sediment Toxicity Testing Results	4-5
4-3	Sediment Effect Values	4-7
4-4	EPA Sediment Quality Criteria	4-8
4-5	Safety Factors Used to Derive Reference Toxicity Values for Indicator Species	4-12
4-6	Basis of the Mammalian Reference Toxicity Value (RTVs) (mg/kg-day)	4-13
4-7	Basis of the Avian Reference Toxicity Values (RTVs) (mg/kg-day)	4-19
4-8	Summary of Available Plant Toxicity Values	4-27

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Table of Contents
Revision: 1
Date: April 1999

TABLE OF CONTENTS (Continued)

LIST OF TABLES (Continued)

<u>Table No.</u>	<u>Title</u>	<u>Page</u>
4-9	Soil Toxicity Testing Results	4-30
5-1	Surface Water Hazard Quotients - Acute	5-4
5-2	Surface Water Hazard Quotients - Chronic	5-5
5-3	Sediment Hazard Quotients	5-7
5-4	Comparison of Maximum Sediment Concentration to U.S. EPA Sediment Quality Criteria	5-10
5-5	Summary of Risk to Aquatic Life	5-12
5-6	Hazard Quotients and Indices, Northern Short-Tailed Shrew, Tar Dump	5-14
5-7	Hazard Quotients and Indices, Northern Short-Tailed Shrew, Hamill Road Dump #3	5-15
5-8	Hazard Quotients and Indices, White-Footed Mouse, Tar Dump	5-17
5-9	Hazard Quotients and Indices, White-Footed Mouse, Hamill Road Dump #3	5-18
5-10	Hazard Quotients and Indices, American Robin, Tar Dump	5-20
5-11	Hazard Quotients and Indices, American Robin, Hamill Road Dump #3	5-21
5-12	Hazard Quotients and Indices, Muskrat, Chattanooga Creek	5-24
5-13	Comparison of Available Plant Toxicity Values to Tar Dump	

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Table of Contents
Revision: 1
Date: April 1999

TABLE OF CONTENTS (Continued)

LIST OF TABLES (Continued)

<u>Table No.</u>	<u>Title</u>	<u>Page</u>
	Maximum Soil Concentrations (0 to 2 feet deep)	5-25
5-14	Comparison of Available Plant Toxicity Values to Hamill Road Dump #3	
	Maximum Soil Concentrations (0 to 2 feet deep)	5-28
6-1	Background Concentrations of Metals in U.S. Soils (mg/kg)	6-8

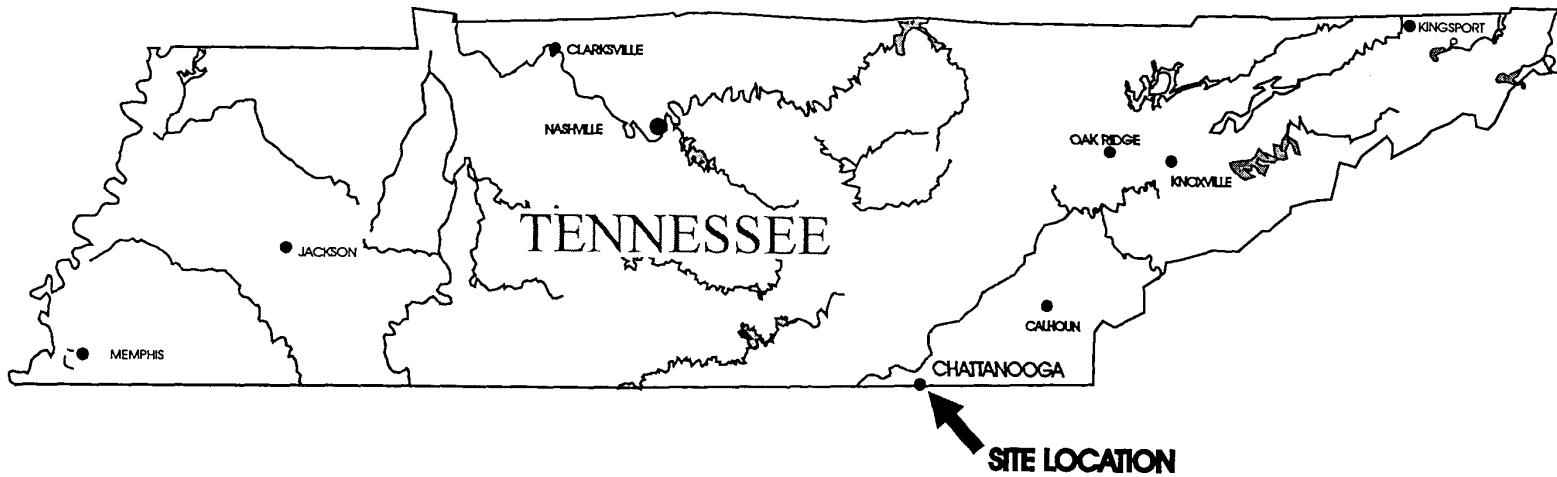
Ecological Risk Assessment
Tennessee Products Site
Section: Section 1
Revision: 1
Date: April 1999

SECTION 1 INTRODUCTION

1.1 SITE BACKGROUND

The Tennessee Products Site is located in Hamilton County, Tennessee (Figure 1-1), and encompasses the portion of the Chattanooga Creek watershed from the Tennessee/Georgia state line to its confluence with the Tennessee River. Chattanooga Creek stems from the slopes of Georgia's Lookout Mountain and flows 26 miles through the heart of downtown Chattanooga before emptying into the Tennessee River (Figure 1-2). The U.S. Environmental Protection Agency (EPA), Tennessee Valley Authority (TVA), and state and local agencies have been studying the creek and its watershed for over 20 years and have documented its severe pollution problems. Several of these surveys provided the impetus for the 1983 posting of the creek against fishing, swimming, or wading.

A major contributor of industrial waste over the years has been the now defunct Chattanooga Coke & Chemical Company (formerly the Tennessee Products Corporation). The Tennessee Products facility is believed to have been the primary source of coal-tar contamination of Chattanooga Creek. Coal-tar, a by-product of the coal carbonization (coke) process, contains numerous harmful constituents such as polycyclic aromatic hydrocarbons (PAHs), benzene, cyanide, and mercury. EPA's 1992 Sediment Profile Study revealed the presence of coal-tar residues in excess of 2 miles downstream of the plant. In some locations, where contaminants were dumped into the creek by the truckload, tar deposits are 6 to 8 feet deep in the stream bed and along its banks. The Tennessee Products Site was proposed for inclusion on the National Priorities List on January 18, 1994.



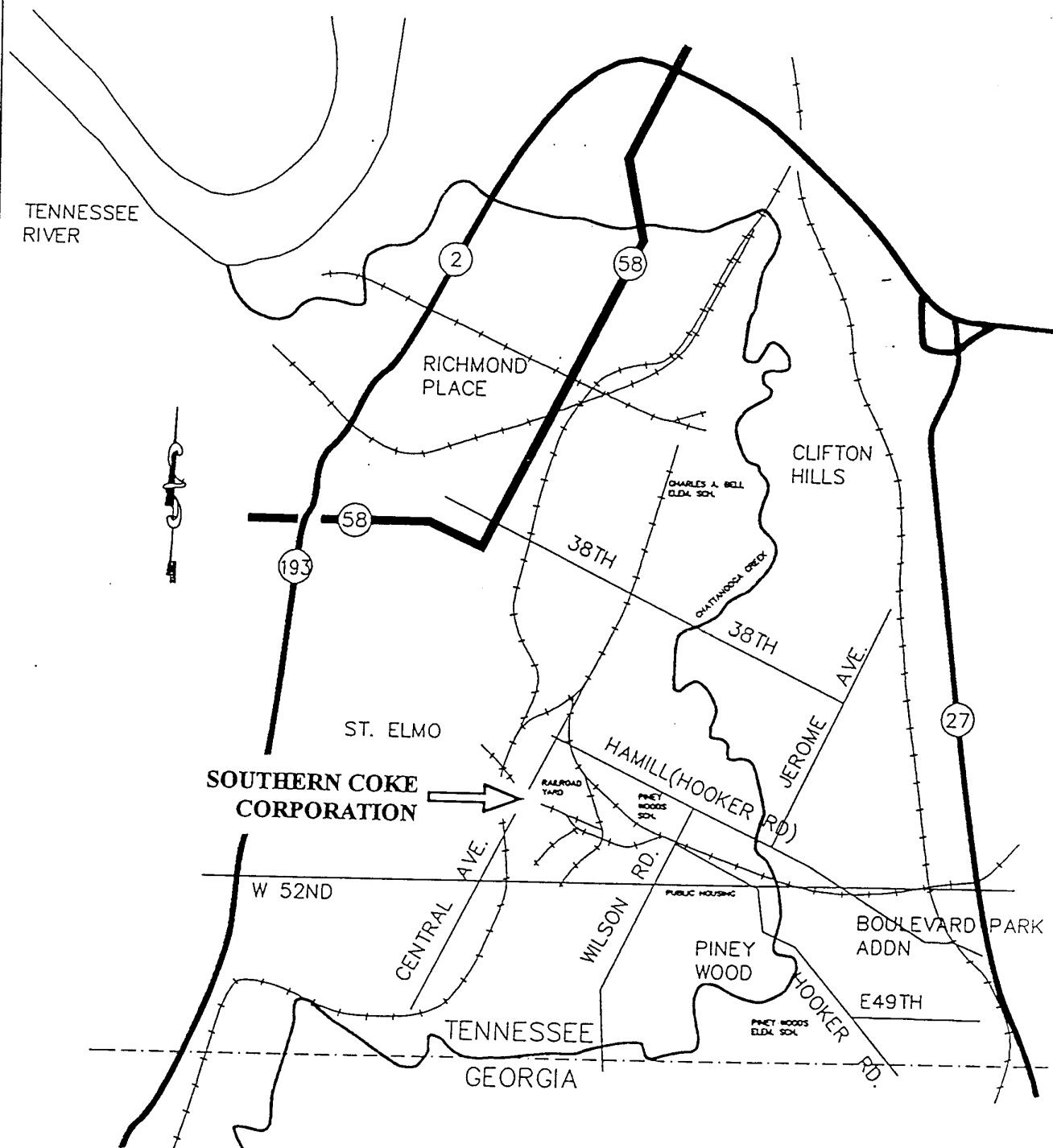
TENNESSEE PRODUCTS CERCLA SITE
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE

GENERAL SITE LOCATION MAP

FIGURE 1-1



DRAWN	BKM	DATE	12/07/94	DES. ENG.	DATE	W. O. NO.	04400-048-093
CHECKED	MSU	DATE	4-1-96	APPROVED	DATE	DWG. NO.	INPRODUCTION



NOTE: NOT TO SCALE

TENNESSEE PRODUCTS CERCLA SITE
CHATTANOOGA, TENNESSEE

SITE LOCATION MAP

FIGURE 1 - 2



DRAWN	BKM	DATE	12/07/94	DES. ENG.	DATE	W. O. NO.	04400-048-093
CHECKED		DATE		APPROVED	DATE	DWG. NO.	TNPROD2.CDR

Ecological Risk Assessment
Tennessee Products Site
Section: Section 1
Revision: 1
Date: April 1999

1.2 PREVIOUS SITE INVESTIGATIONS

Numerous investigations have been conducted in the Chattanooga Creek watershed at the Tennessee Products Site in the last twenty years. During the 1970s and the 1980s, control of water quality became a significant environmental issue in Chattanooga Creek as the Federal and Tennessee Department of Health and Environment initiated the National Pollutant Discharge Elimination System (NPDES) permitting program. Two water quality studies were conducted in the 1970s, focusing on the classification of Chattanooga Creek and identification of major sources of contamination within the watershed. A sediment survey was conducted along Chattanooga Creek in 1980 by the Tennessee Valley Authority (TVA) that indicated that much of the sediment associated with the creek was contaminated by toxic priority pollutants. In 1990, Dynamac Corporation conducted an updated water and sediment study of the creek for the EPA, Region IV. The 1980 and 1990 studies both concluded that water quality and sediment characteristics in Chattanooga Creek, downstream of Dobbs Branch, have not improved significantly since the initial ecological studies.

More extensive investigations were performed to collect baseline data on sediment and surface water quality at the Tennessee Products Site. In 1990, the EPA initiated a study to determine the current environmental quality of Chattanooga Creek. A report of this study was generated in May 1992 that documents environmental quality of the creek and identifies preliminary indications that at least 17 industrial/commercial facilities may have been sources of contamination within the Chattanooga Creek watershed. Water and sediment samples collected and analyzed in August 1990 as part of this study also indicated the continued presence of heavy metals in the Chattanooga Creek watershed. Over 15 polynuclear aromatic hydrocarbons (PAHs) were identified in the sediments of the creek. It was recommended in this 1992 EPA report that more biological sampling be conducted in the Chattanooga Creek watershed to

Ecological Risk Assessment
Tennessee Products Site
Section: Section 1
Revision: 1
Date: April 1999

conclusively demonstrate the impacts of identified contaminants on aquatic resources. Also, in order to correlate specific industries/facilities with the identified contamination load documented within the watershed, it was recommended that additional soil, sediment, and water sampling be taken.

A sediment profile study of Chattanooga Creek was conducted in April and August of 1992 by EPA, Environmental Services Division (ESD), and the Tennessee Department of Environment and Conservation. The primary objective of this study was to evaluate sediment quality along the portion of Chattanooga Creek in Hamilton County, Tennessee. Additionally, an ecological assessment of Chattanooga Creek was performed from May through September of 1992 by the EPA/ESD. Tennessee Wildlife Resources Agency and Tennessee Valley Authority conducted a fish collection as part of this survey.

In the Fall 1994/Spring 1995 time period, Roy F. Weston, Inc. (WESTON), under contract to EPA, conducted floodplain soil, surface water, sediment, and Asiatic clam (*Corbicula fluminea*) tissue sampling at the Tennessee Products Site. In addition, a biological characterization of the site was conducted, and included a vegetation and vertebrate survey. Sediment and soil toxicity tests were also conducted. The focus of all activities was the reach of Chattanooga Creek between Hamill Dump No. 1 (just upstream of Hamill Road) to approximately 600 feet below the 38th Street Bridge across from the Alton Park School. This latest round of data collection was used as the basis for the ecological risk assessment.

This ecological risk assessment was initially published in April 1996. After the initial risk assessment was completed, the EPA remediated some of the areas in and around the Chattanooga Creek adjacent to the Tennessee Products site.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 1
Revision: 1
Date: April 1999

The EPA identified two areas in which the conclusions of the initial ecological risk assessment should be refined with site-specific data: sediment toxicity and bioaccumulation. These studies were conducted by WESTON under the EPA's Environmental Response Team (ERT)/Response Engineering and Analytical Contract (REAC) and reported as *Supplemental Investigation for the Ecological Risk Assessment of the Chattanooga Creek/Tennessee Products Superfund Site, Chattanooga, TN, February, 1999* (EPA, 1999).

Sediment toxicity tests were conducted using samples of coal tar and sediment collected from the creek. In addition, sediment samples were submitted for chemical analysis. An earthworm bioaccumulation study was conducted using site soil samples. The results of this study were then entered into the exposure models for worm-eating mammals and birds to obtain a more realistic assessment of risks associated with that pathway.

This version of the report presents the initial ecological risk assessment and the results of the two supplemental studies. The supplemental study results are summarized in Subsection 7.2 of this document, and presented in their entirety in Appendix E (EPA, 1999). The balance of the report is reissued with only minor changes from the April, 1996 Draft. The EPA and WESTON recognize that the guidance for the preparation of ecological risk assessments has evolved since this document was first presented in early 1996. In EPA's judgement, the site issues do not warrant a complete revision of the April 1996 ecological risk assessment pursuant to the updated guidance at this time.

1.3 RISK ASSESSMENT OBJECTIVES AND GUIDANCE

The ecological risk assessment is being conducted as part of the CERCLA Remedial Investigation/Feasibility Study (RI/FS) process. The objectives of this ecological risk assessment

Ecological Risk Assessment
Tennessee Products Site
Section: Section 1
Revision: 1
Date: April 1999

are to identify and estimate the potential ecological impacts associated with the chemicals of potential concern detected in soils, surface waters, sediment, and clams at the Tennessee Products Site in Chattanooga, Tennessee. The assessment focuses on the potential for exposure and impact to aquatic and terrestrial flora and fauna that inhabit or are potential inhabitants of the study area. For purposes of the risk assessment, the study area is defined as the reach of the Chattanooga Creek between Hamill Dump No. 1 (just upstream of Hamill Road) to approximately 600 feet below 38th Street Bridge across from the Alton Park School. In addition to the aquatic and riparian/floodplain areas associated with this reach of stream, the area of concern also includes terrestrial areas bounded by Jerome Avenue to the east and the Alton Park neighborhood to the west. This risk assessment will use those data collected in the most recent Fall 1994/Spring 1995 field studies conducted by WESTON for EPA.

The technical guidance for performance of the ecological risk assessment comes primarily from the following sources: *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment* (EPA Region 4, 1995a), *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment* (EPA, 1994), *Wildlife Exposure Factors Handbook* (EPA, 1993a), *Framework for Ecological Risk Assessment* (EPA, 1992a), *Summary Report on Issues in Ecological Risk Assessment* (EPA, 1991a), *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference* (EPA, 1989a), *Risk Assessment Guidance for Superfund — Volume II, Environmental Evaluation Manual* (EPA, 1989b), and *Ecological Risk Assessment* (EPA, 1986). Numerous other information sources were used to assist in this report preparation and are included in the references section. The EPA and WESTON recognize that the guidance for the preparation of ecological risk assessments has evolved since this document was first presented in April, 1996. In EPA's judgement, the site issues do not warrant a complete revision of the April 1996 ecological risk assessment pursuant to the updated guidance at this time.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 1
Revision: 1
Date: April 1999

The subsections that follow provide the objectives, approach, and results of the evaluation of potential ecological impacts associated with chemicals of potential concern at the Tennessee Products Site.

SECTION 2

PROBLEM FORMULATION

Problem formulation is the first step of the ecological risk assessment process, and establishes the goals, breadth, and focus of the assessment (EPA, 1992a). It provides a qualitative evaluation of the contaminants of potential concern, habitats, receptors, and exposure pathways, and selection of endpoints for further study (EPA, 1991a). The ultimate goal of problem formulation is to develop a site conceptual model that identifies the potential chemical transport pathways, receptors, and the areas of primary concern to be addressed in the ecological risk assessment. The technical components of problem formulation include:

- Data Evaluation and Selection of Chemicals of Potential Concern
- Characterization of Habitats and Ecological Receptors
- Identification of Exposure Pathways
- Selection of Assessment and Measurement Endpoints
- Presentation of Site Conceptual Model

Comprehensive discussions of each of these technical components are presented in the following subsections.

2.1 DATA EVALUATION AND REDUCTION

2.1.1 Introduction

The objectives of the data evaluation and reduction are to review and to summarize the analytical data for media of concern at the site (i.e., soils, surface water, sediment, and clams), and to select the chemicals of potential concern (COPCs) to be evaluated in the ecological risk assessment.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

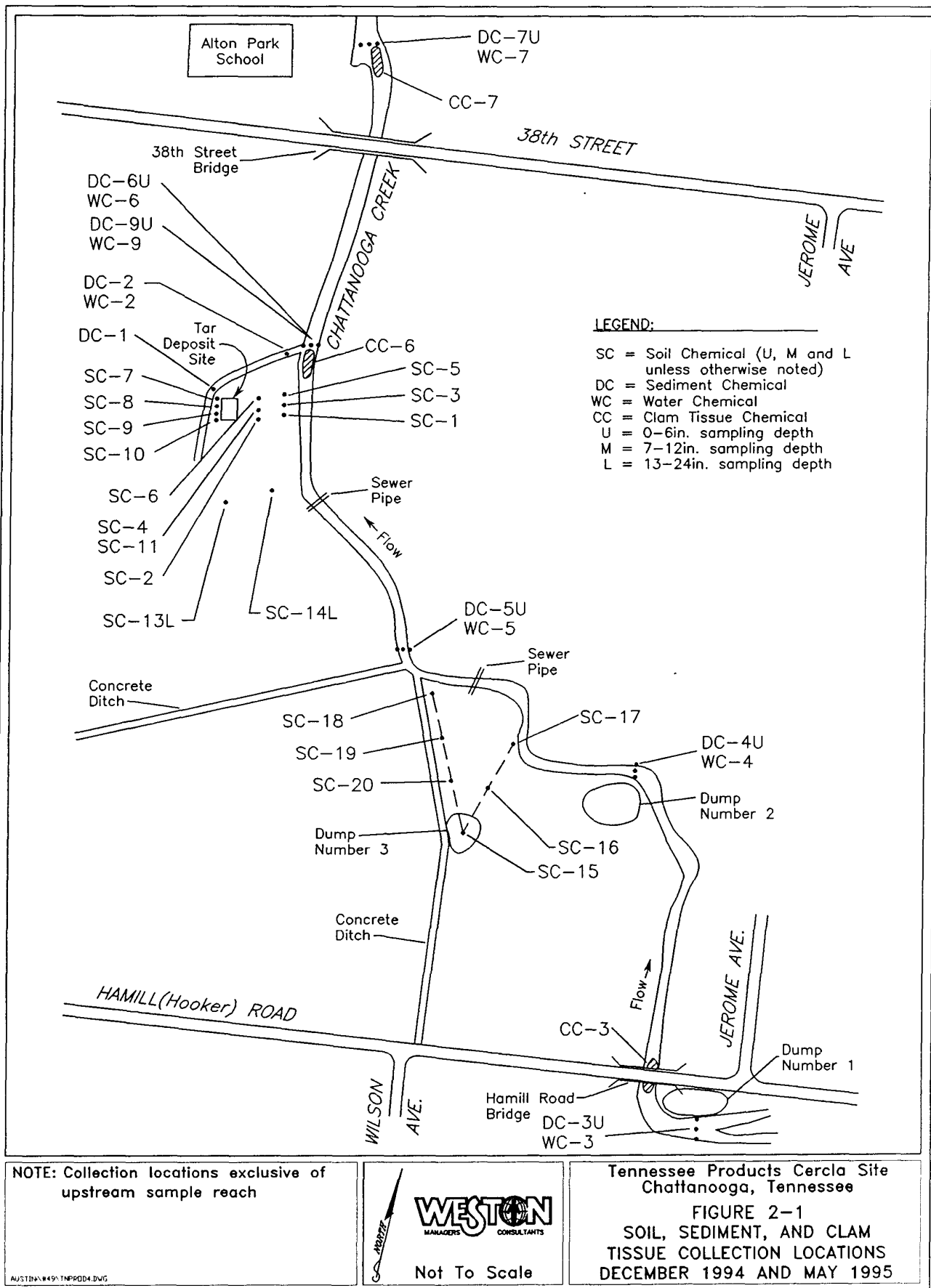
This section summarizes the data that were collected at the Tennessee Products Site as part of the Ecological Investigation conducted by WESTON for EPA Region 4 during December 1994 and May 1995. The full data set, on which the summaries are based, is presented in Appendix A. Media that were sampled during this investigation include floodplain soils associated with Chattanooga Creek, and surface water, sediment, and clams from Chattanooga Creek. The geographic area in which the sampling was performed was the reach of the Chattanooga Creek between Hamill Road Dump No. 1 (just upstream of Hamill Road) to approximately 600 feet below 38th Street Bridge across from the Alton Park School, and the associated aquatic and riparian/floodplain areas (see Figure 2-1).

All samples collected during this investigation were analyzed for metals, volatile organic compounds, semi-volatile organic compounds, pesticides, and PCBs, as defined in the *Field Sampling and Analysis Plan, Ecological Investigation, Tennessee Products Site* (WESTON, 1994).

2.1.2 Guidelines for Data Reduction

The following guidelines for data reduction were used to produce the data summaries for each medium. These approaches are consistent with *Risk Assessment Guidance for Superfund (RAGS)* (EPA, 1989c):

- If a chemical was not positively identified in any sample from a given medium, because it was reported as a nondetect or because of blank contamination (as explained below), it was eliminated as a potential chemical of concern for that medium, and excluded from the data summary tables.



Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

- If a chemical was reported in a field sample and a method or field blank, it was only considered as a positive identification if the chemical was present in the field sample at a concentration greater than 10 times (for common laboratory contaminants), or 5 times (for all other substances) the maximum concentration reported in any blank. Common laboratory contaminants include acetone, methylene chloride, methyl ethyl ketone (2-butanone), phthalate esters, and toluene.
- "J" values are estimated concentrations reported below the minimum confident quantitation limit. All data with J qualifiers were assumed to be positive identifications for that medium.
- "R" values are data that QC indicates are unusable, and were not included in the data summary.
- If a chemical was reported as a non-detect in a sample set containing at least one detection, it was assumed to be present at one-half of the sample quantitation limit for that sample in the calculation of the 95% upper confidence limit (UCL) concentration.
- Duplicate samples from the same sampling location were considered as one data point in summarizing the analytical results. The values reported for the duplicate samples were averaged, and this average concentration was assumed as the concentration for that sampling location. However, a minimum and maximum detected concentration were reported for individual duplicate samples to obtain the range of detected concentrations.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

- For the 0-2 foot soil depth interval, the results from multiple depths at a single location were averaged, and then the average concentration at that location was used to summarize the data and calculate the statistics. However, a minimum and maximum detected concentration were reported for individual sampling depths to obtain a range of detected concentrations.

2.1.3 Soil Sampling Results

Soil samples were collected at two areas of known tar deposits within the floodplain of Chattanooga Creek - the Tar Deposit Site and Hamill Road Dump No. 3 - during the December 1994 sampling event. Twelve locations were sampled at the Tar Deposit Site and 6 locations were sampled at the Hamill Road Dump No. 3. Soil sampling locations are shown in Figure 2-1. At each location (with the exception of sampling locations SC-13 and SC-14), samples from 3 depth intervals were collected: 0-6 inches, 7-12 inches, and 13-24 inches. Samples SC-13 and SC-14 were taken in a seasonally flooded depression approximately 300 feet away from the tar pit area. Only the lower depth interval (13-24 inches) was collected at these two locations, since subsurface contamination was suspected in these areas. The results, however, showed lower concentrations of contaminants than many of the samples collected near the tar dump. Thus, these two locations were not included in the data summary for the tar dump.

Data summaries for soil sampling results were prepared separately for the Tar Dump and Hamill Road Dump No. 3, and for 2 different depth intervals: 0-6 inches and 0-2 feet. These data summaries are presented in Tables 2-1 through 2-4. The use of these two depth intervals is discussed further in Section 3.2.

Table 2-1
Data Summary for Chemicals Detected in Tar Dump Soil (0 to 0.5 foot)
Tennessee Products Site, Chattanooga, TN

Chemical	Frequency of Detection ^a	Range of Detected Concentrations ^b (Organics - µg/kg) (Inorganics - mg/kg)	Range of Detection Limits ^b (Organics - µg/kg) (Inorganics - mg/kg)	Mean Concentration ^c (Organics - µg/kg) (Inorganics - mg/kg)	Chemical Selected as COPC
Organics					
Acetone	2 / 10	1.50E+04 - 9.00E+04	1.20E+01 - 3.00E+01	5.25E+04	Yes
alpha - BHC	5 / 9	3.50E+01 - 8.50E+02	4.80E+01 - 5.50E+02	4.31E+02	Yes
beta-BHC	8 / 8	1.90E+01 - 4.50E+02	-	2.47E+02	Yes
delta-BHC	5 / 6	1.20E+01 - 2.60E+02	1.50E+02 - 1.50E+02	1.09E+02	Yes
gamma-BHC	10 / 10	8.80E+00 - 2.90E+02	-	9.07E+01	Yes
Carbazole	4 / 10	8.20E+01 - 2.70E+02	3.90E+02 - 4.60E+03	2.15E+02	Yes
gamma-Chlordane	1 / 10	9.00E+01 - 9.00E+01	4.20E+00 - 4.80E+01	9.00E+01	Yes
Dieldrin	7 / 10	1.10E+01 - 3.90E+03	8.10E+00 - 2.00E+01	1.76E+03	Yes
Endosulfan I	3 / 9	1.60E+01 - 1.00E+02	4.20E+00 - 8.00E+01	6.27E+01	Yes
Endosulfan II	3 / 10	5.70E+01 - 1.10E+02	8.10E+00 - 1.10E+02	8.60E+01	Yes
Endrin aldehyde	1 / 10	8.70E+01 - 8.70E+01	8.10E+00 - 9.30E+01	8.70E+01	Yes
Heptachlor	4 / 8	4.30E+01 - 3.00E+02	4.20E+00 - 3.60E+02	1.96E+02	Yes
Heptachlor epoxide	4 / 10	6.90E+00 - 8.80E+01	4.20E+00 - 4.70E+01	5.37E+01	Yes
Hexachlorobenzene	5 / 10	7.20E+01 - 5.80E+02	3.90E+02 - 4.20E+02	3.86E+02	Yes
2-Methylnaphthalene	3 / 10	9.20E+01 - 1.80E+02	3.90E+02 - 4.60E+03	1.24E+02	Yes
Naphthalene	4 / 10	1.30E+02 - 3.70E+02	3.90E+02 - 4.60E+03	2.48E+02	Yes
PAHs					
Acenaphthylene	9 / 10	7.10E+01 - 2.10E+03	4.00E+02 - 4.00E+02	5.74E+02	Yes
Anthracene	10 / 10	4.10E+01 - 1.70E+03	5.60E+02 - 5.60E+02	4.65E+02	Yes
Benzo(a)anthracene	10 / 10	3.60E+02 - 1.30E+04	-	3.36E+03	Yes
Benzo(a)pyrene	10 / 10	4.40E+02 - 1.50E+04	-	4.05E+03	Yes
Benzo(b and/or k)fluoranthene	10 / 10	9.00E+02 - 3.80E+04	-	9.08E+03	Yes
Benzo(g,h,i)perylene	10 / 10	4.50E+02 - 8.60E+03	5.60E+02 - 5.60E+02	2.27E+03	Yes
Chrysene	10 / 10	4.60E+02 - 1.30E+04	-	3.68E+03	Yes
Dibenzo(a,h)anthracene	9 / 10	1.20E+02 - 5.40E+03	4.60E+03 - 4.60E+03	1.20E+03	Yes
Fluoranthene	10 / 10	4.70E+02 - 1.30E+04	-	4.02E+03	Yes
Indeno(1,2,3-cd)pyrene	10 / 10	3.10E+02 - 1.20E+04	-	3.04E+03	Yes
Phenanthrene	10 / 10	8.30E+01 - 2.40E+03	-	8.10E+02	Yes
Pyrene	10 / 10	4.10E+02 - 1.40E+04	-	3.74E+03	Yes
Tetrachloroethene	3 / 10	2.00E+00 - 4.00E+00	1.20E+01 - 1.50E+03	3.00E+00	Yes
1,1,1-Trichloroethane	2 / 10	2.00E+00 - 3.00E+00	1.20E+01 - 1.50E+03	2.50E+00	Yes
Trichloroethylene	1 / 10	2.00E+00 - 2.00E+00	1.20E+01 - 1.50E+03	2.00E+00	Yes
Inorganics					
Aluminum	10 / 10	1.60E+03 - 1.40E+04	-	1.03E+04	Yes
Arsenic	10 / 10	3.70E+00 - 9.50E+00	-	6.59E+00	Yes
Barium	10 / 10	6.80E+01 - 1.40E+02	-	1.12E+02	Yes
Calcium	10 / 10	1.00E+03 - 2.90E+03	-	1.87E+03	No ^d
Chromium (total)	10 / 10	1.80E+01 - 1.70E+02	-	8.04E+01	Yes
Cobalt	6 / 10	1.10E+01 - 1.80E+01	1.00E+01 - 2.00E+01	1.51E+01	Yes
Copper	1 / 10	5.90E+01 - 5.90E+01	2.00E+01 - 5.00E+01	5.90E+01	Yes
Iron	10 / 10	1.30E+04 - 2.10E+04	-	1.78E+04	Yes
Lead	10 / 10	1.70E+01 - 1.30E+02	-	6.77E+01	Yes
Magnesium	10 / 10	6.30E+02 - 1.10E+03	-	8.49E+02	No ^d
Manganese	10 / 10	6.50E+02 - 9.00E+02	-	7.78E+02	Yes
Mercury	5 / 10	3.40E-01 - 7.90E-01	7.00E-02 - 1.00E-01	4.38E-01	Yes
Nickel	10 / 10	1.20E+01 - 3.20E+01	-	2.06E+01	Yes
Silver	2 / 10	2.80E+00 - 2.70E+01	8.10E-01 - 3.00E+00	1.49E+01	Yes
Vanadium	10 / 10	1.70E+01 - 2.60E+01	-	2.18E+01	Yes
Zinc	10 / 10	5.20E+01 - 2.20E+02	-	1.25E+02	Yes

a = Number of sampling locations at which the chemical was detected compared with the total number of sampling locations; duplicates at a location were averaged and considered as one sample.

b = Range of detected concentrations was based on the raw data prior to averaging the duplicates at a location.

c = Arithmetic mean was based on averaging detected values after averaging duplicates at a location.

d = Essential nutrient and low toxicity (EPA Region 4, 1995b).

Table 2-2
Data Summary for Chemicals Detected in Tar Dump Soil (0 to 2 feet)
Tennessee Products Site, Chattanooga, TN

Chemical	Frequency of Detection ^a	Range of Detected Concentrations ^b (Organics - µg/kg) (Inorganics - mg/kg)	Range of Detection Limits ^b (Organics - µg/kg) (Inorganics - mg/kg)	Mean Concentration ^c (Organics - µg/kg) (Inorganics - mg/kg)	Chemical Selected as COPC
Organics					
Acetone	4 / 10	5.90E+02 - 9.00E+04	1.20E+01 - 1.20E+04	1.92E+04	Yes
Aldrin	1 / 10	2.80E+00 - 2.80E+00	3.00E+00 - 9.10E+01	1.76E+01	Yes
alpha - BHC	9 / 10	2.10E+01 - 3.60E+03	2.20E+00 - 6.40E+02	3.06E+02	Yes
beta-BHC	10 / 10	7.00E+00 - 1.30E+03	6.50E+00 - 6.50E+00	2.13E+02	Yes
delta-BHC	7 / 9	2.70E+00 - 5.10E+02	2.20E+00 - 1.50E+02	1.02E+02	Yes
gamma-BHC	10 / 10	3.80E+00 - 1.10E+03	2.20E+00 - 2.00E+01	9.96E+01	Yes
Carbazole	6 / 10	7.70E+01 - 4.40E+02	3.80E+02 - 4.60E+03	4.34E+02	Yes
alpha-Chlordane	1 / 9	3.60E+01 - 3.60E+01	4.00E+00 - 3.70E+02	3.98E+01	Yes
gamma-Chlordane	1 / 10	9.00E+01 - 9.00E+01	2.00E+00 - 9.10E+01	3.34E+01	Yes
DDD	2 / 10	2.70E+00 - 3.00E+01	4.30E+00 - 1.10E+02	1.45E+01	Yes
DDT	1 / 10	7.80E+00 - 7.80E+00	3.80E+00 - 1.80E+02	3.35E+01	Yes
Dibenzofuran	1 / 10	1.00E+02 - 1.00E+02	3.80E+02 - 4.60E+03	4.21E+02	Yes
Dieldrin	10 / 10	8.00E+00 - 3.90E+03	8.10E+00 - 2.80E+02	5.10E+02	Yes
Endosulfan I	5 / 9	1.60E+01 - 1.00E+02	4.00E+00 - 1.20E+02	3.04E+01	Yes
Endosulfan II	5 / 10	3.40E+00 - 1.20E+02	4.30E+00 - 1.10E+02	4.08E+01	Yes
Endrin	1 / 10	7.00E+01 - 1.60E+02	3.80E+00 - 1.80E+02	2.54E+01	Yes
Endrin aldehyde	2 / 10	3.90E+01 - 8.70E+01	4.30E+00 - 1.80E+02	3.78E+01	Yes
Heptachlor	4 / 10	4.30E+01 - 3.00E+02	2.00E+00 - 3.60E+02	1.03E+02	Yes
Heptachlor epoxide	7 / 10	6.90E+00 - 1.60E+02	2.00E+00 - 1.00E+02	2.82E+01	Yes
Hexachlorobenzene	5 / 10	7.20E+01 - 5.80E+02	3.80E+02 - 3.50E+03	5.91E+02	Yes
Methoxychlor	3 / 10	2.00E+01 - 9.90E+01	2.00E+01 - 9.10E+02	9.07E+01	Yes
2-Methylnaphthalene	3 / 10	9.20E+01 - 1.80E+02	3.80E+02 - 4.60E+03	5.76E+02	Yes
Naphthalene	7 / 10	7.00E+01 - 4.60E+02	3.80E+02 - 4.60E+03	4.18E+02	Yes
PAHs					
Acenaphthylene	10 / 10	6.50E+01 - 4.50E+03	3.90E+02 - 5.40E+02	6.06E+02	Yes
Anthracene	10 / 10	3.90E+01 - 3.50E+03	3.90E+02 - 5.60E+02	5.48E+02	Yes
Benzo(a)anthracene	10 / 10	2.30E+02 - 3.80E+04	-	4.62E+03	Yes
Benzo(a)pyrene	10 / 10	4.20E+02 - 5.00E+04	3.80E+02 - 8.70E+02	5.39E+03	Yes
Benzo(b and/or k)fluoranthene	10 / 10	3.00E+02 - 9.80E+04	-	1.10E+04	Yes
Benzo(g,h,i)perylene	10 / 10	4.50E+02 - 2.20E+04	3.80E+02 - 8.70E+02	2.80E+03	Yes
Chrysene	10 / 10	1.60E+02 - 4.00E+04	-	4.95E+03	Yes
Dibenzo(a,h)anthracene	10 / 10	1.10E+02 - 1.20E+04	3.80E+02 - 4.60E+03	1.51E+03	Yes
Fluoranthene	10 / 10	2.50E+02 - 4.60E+04	-	5.94E+03	Yes
Indeno(1,2,3-cd)pyrene	10 / 10	3.00E+02 - 2.70E+04	3.80E+02 - 3.80E+02	3.71E+03	Yes
Phenanthrene	10 / 10	3.90E+01 - 7.40E+03	-	1.10E+03	Yes
Pyrene	10 / 10	3.80E+02 - 4.20E+04	3.80E+02 - 3.80E+02	4.97E+03	Yes
Tetrachloroethene	4 / 10	2.00E+00 - 4.00E+00	1.20E+01 - 1.60E+03	1.16E+01	Yes
1,1,1-Trichloroethane	3 / 10	2.00E+00 - 8.00E+00	1.20E+01 - 1.60E+03	8.57E+01	Yes
Trichloroethylene	2 / 10	2.00E+00 - 3.00E+00	1.20E+01 - 1.60E+03	1.21E+02	Yes
Xylenes (total)	1 / 10	1.00E+00 - 1.00E+00	1.20E+01 - 1.60E+03	4.33E+00	Yes
Inorganics					
Aluminum	10 / 10	1.60E+03 - 1.40E+04	-	1.03E+04	Yes
Arsenic	10 / 10	2.70E+00 - 1.40E+01	-	7.02E+00	Yes
Barium	10 / 10	6.20E+01 - 1.50E+02	1.40E+02 - 1.40E+02	1.02E+02	Yes
Beryllium	2 / 10	1.30E+00 - 1.40E+00	1.00E+00 - 2.00E+00	1.12E+00	Yes
Cadmium	3 / 10	2.10E-01 - 3.70E-01	2.00E-01 - 1.00E+00	2.44E-01	Yes
Calcium	10 / 10	5.30E+02 - 2.90E+03	-	1.35E+03	No ^d
Chromium (total)	10 / 10	1.20E+01 - 3.60E+02	-	7.95E+01	Yes
Cobalt	8 / 10	1.10E+01 - 2.40E+01	6.00E+00 - 2.00E+01	1.48E+01	Yes
Copper	3 / 10	6.20E+00 - 5.90E+01	5.00E+00 - 5.00E+01	2.72E+01	Yes
Iron	10 / 10	1.70E+03 - 2.10E+04	-	1.73E+04	Yes
Lead	10 / 10	9.10E+00 - 1.30E+02	-	4.42E+01	Yes
Magnesium	10 / 10	4.50E+02 - 1.10E+03	-	7.20E+02	No ^d
Manganese	10 / 10	3.30E+02 - 1.20E+03	-	7.46E+02	Yes
Mercury	7 / 10	1.40E-01 - 7.90E-01	5.00E-02 - 2.00E-01	3.33E-01	Yes
Nickel	10 / 10	1.00E+01 - 4.10E+01	8.00E+00 - 9.00E+00	2.11E+01	Yes
Potassium	3 / 10	7.00E+00 - 7.50E+02	3.10E+02 - 1.10E+03	3.43E+02	No ^d
Selenium	4 / 10	9.30E-01 - 1.60E+00	6.60E-01 - 2.00E+00	7.97E-01	Yes
Silver	2 / 10	2.80E+00 - 2.70E+01	7.70E-01 - 3.00E+00	6.04E+00	Yes
Vanadium	10 / 10	1.40E+01 - 2.60E+01	-	2.05E+01	Yes
Zinc	10 / 10	4.10E+01 - 2.20E+02	3.00E+01 - 5.00E+01	1.02E+02	Yes
Cyanide	1 / 10	7.80E-01 - 7.80E-01	5.40E-01 - 7.40E-01	4.80E-01	Yes

a = Number of sampling locations at which the chemical was detected compared with the total number of sampling locations; duplicates at a location were averaged and considered as one sample.

b = Range of detected concentrations was based on the raw data prior to averaging the duplicates at a location.

c = Arithmetic mean was based on averaging detected values after averaging duplicates at a location.

d = Essential nutrient and low toxicity (EPA Region 4, 1995b).

Table 2-3
Data Summary for Chemicals Detected in Hamill Road Dump #3 Soil (0 to 0.5 foot)
Tennessee Products Site, Chattanooga, TN

Chemical	Frequency of Detection	Range of Detected Concentrations ^b (Organics - µg/kg) (Inorganics - mg/kg)	Range of Detection Limits ^b (Organics - µg/kg) (Inorganics - mg/kg)	Mean Concentration ^c (Organics - µg/kg) (Inorganics - mg/kg)	Chemical Selected as COPC
Organics					
Aldrin	1 / 6	1.30E+00 - 1.30E+00	2.30E+00 - 2.20E+01	1.30E+00	Yes
beta-BHC	1 / 6	3.80E+02 - 3.80E+02	5.00E+00 - 2.70E+02	3.80E+02	Yes
delta-BHC	5 / 6	3.20E+00 - 9.30E+01	1.10E+01 - 1.10E+01	4.65E+01	Yes
gamma-BHC	3 / 4	4.40E+00 - 1.10E+02	4.00E+01 - 4.00E+01	3.97E+01	Yes
Carbazole	3 / 6	5.30E+01 - 1.30E+02	4.30E+02 - 2.40E+04	8.33E+01	Yes
DDT	1 / 6	4.40E+01 - 4.40E+01	4.50E+00 - 5.00E+01	4.40E+01	Yes
Dibenzofuran	1 / 6	5.60E+01 - 5.60E+01	4.20E+02 - 2.40E+04	5.60E+01	Yes
Dieldrin	6 / 6	1.20E+01 - 3.40E+02	-	1.31E+02	Yes
Endosulfan I	5 / 5	8.20E+00 - 2.00E+02	-	6.22E+01	Yes
Endosulfan II	3 / 5	5.00E+00 - 5.40E+01	2.00E+01 - 4.30E+01	3.47E+01	Yes
Endosulfan sulfate	1 / 6	3.10E+01 - 3.10E+01	4.40E+00 - 4.30E+01	3.10E+01	Yes
Endrin	1 / 6	3.20E+01 - 3.20E+01	4.40E+00 - 4.30E+01	3.20E+01	Yes
Heptachlor	2 / 6	8.50E+00 - 9.20E+01	4.00E+00 - 2.20E+01	5.03E+01	Yes
Hexachlorobenzene	2 / 6	5.40E+01 - 3.00E+02	4.30E+02 - 2.40E+04	1.77E+02	Yes
2-Methylnaphthalene	1 / 6	8.20E+01 - 8.20E+01	4.20E+02 - 2.40E+04	8.20E+01	Yes
Naphthalene	4 / 6	6.00E+01 - 1.80E+02	4.40E+02 - 2.40E+04	1.21E+02	Yes
PAHs					
Acenaphthylene	5 / 6	8.00E+01 - 3.40E+02	2.40E+04 - 2.40E+04	1.84E+02	Yes
Anthracene	6 / 6	8.90E+01 - 2.50E+03	-	6.43E+02	Yes
Benzo(a)anthracene	6 / 6	6.40E+02 - 2.00E+04	-	4.59E+03	Yes
Benzo(a)pyrene	6 / 6	7.50E+02 - 1.90E+04	-	4.14E+03	Yes
Benzo(b and/or k)fluoranthene	6 / 6	1.80E+03 - 4.50E+04	-	1.02E+04	Yes
Benzo(g,h,i)perylene	4 / 6	3.70E+02 - 1.10E+03	1.10E+03 - 2.40E+04	6.35E+02	Yes
Chrysene	6 / 6	8.00E+02 - 2.30E+04	-	5.23E+03	Yes
Dibenzo(a,h)anthracene	6 / 6	2.40E+02 - 5.00E+03	-	1.16E+03	Yes
Fluoranthene	6 / 6	9.20E+02 - 3.90E+04	-	8.75E+03	Yes
Indeno(1,2,3-cd)pyrene	6 / 6	6.00E+02 - 1.30E+04	-	2.90E+03	Yes
Phenanthrene	6 / 6	2.60E+02 - 5.70E+03	-	1.40E+03	Yes
Pyrene	6 / 6	8.60E+02 - 3.70E+04	-	7.51E+03	Yes
Styrene	1 / 6	2.00E+00 - 2.00E+00	1.20E+01 - 1.40E+01	2.00E+00	Yes
1,1,1-Trichloroethane	5 / 6	9.00E+00 - 3.50E+01	1.40E+01 - 1.40E+01	1.70E+01	Yes
Inorganics					
Aluminum	6 / 6	9.20E+03 - 1.30E+04	-	1.15E+04	Yes
Arsenic	6 / 6	7.90E+00 - 1.10E+01	-	9.80E+00	Yes
Barium	6 / 6	8.60E+01 - 1.30E+02	-	1.08E+02	Yes
Calcium	6 / 6	1.30E+03 - 2.30E+03	-	1.67E+03	No ^d
Chromium (total)	6 / 6	4.00E+01 - 8.60E+01	-	5.93E+01	Yes
Cobalt	6 / 6	1.30E+01 - 1.80E+01	-	1.53E+01	Yes
Copper	1 / 6	5.40E+01 - 5.40E+01	2.00E+01 - 5.00E+01	5.40E+01	Yes
Iron	6 / 6	1.60E+04 - 2.10E+04	-	1.93E+04	Yes
Lead	6 / 6	4.10E+01 - 7.40E+01	-	5.98E+01	Yes
Magnesium	6 / 6	7.30E+02 - 9.10E+02	-	8.20E+02	No ^d
Manganese	6 / 6	7.00E+02 - 1.30E+03	-	1.01E+03	Yes
Mercury	4 / 6	2.10E-01 - 3.30E-01	2.00E-01 - 2.00E-01	2.93E-01	Yes
Nickel	6 / 6	1.60E+01 - 2.70E+01	-	2.07E+01	Yes
Potassium	1 / 6	6.40E+02 - 6.40E+02	5.90E+02 - 7.70E+02	6.40E+02	No ^d
Selenium	1 / 6	2.10E+00 - 2.10E+00	7.90E-01 - 2.00E+00	2.10E+00	Yes
Vanadium	6 / 6	1.90E+01 - 2.50E+01	-	2.30E+01	Yes
Zinc	6 / 6	7.80E+01 - 1.40E+02	-	1.12E+02	Yes
Cyanide	1 / 6	1.50E+00 - 1.50E+00	6.00E-01 - 6.90E-01	1.50E+00	Yes

a = Number of sampling locations at which the chemical was detected compared with the total number of sampling locations; duplicates at a location were averaged and considered as one sample.

b = Range of detected concentrations was based on the raw data prior to averaging the duplicates at a location.

c = Arithmetic mean was based on averaging detected values after averaging duplicates at a location.

d = Essential nutrient and low toxicity (EPA Region 4, 1995b).

Table 2-4
Data Summary for Chemicals Detected in Hamill Road Dump #3 Soil (0 to 2 feet)
Tennessee Products Site, Chattanooga, TN

Chemical	Frequency of Detection ^a	Range of Detected Concentrations ^b (Organics - µg/kg) (Inorganics - mg/kg)	Range of Detection Limits ^b (Organics - µg/kg) (Inorganics - mg/kg)	Mean Concentration ^c (Organics - µg/kg) (Inorganics - mg/kg)	Chemical Selected as COPC
Organics					
Aldrin	1 / 6	1.30E+00 - 1.30E+00	2.10E+00 - 2.20E+01	1.15E+00	Yes
beta-BHC	2 / 6	1.40E+00 - 3.80E+02	2.10E+00 - 2.70E+02	1.08E+02	Yes
delta-BHC	5 / 6	3.20E+00 - 9.30E+01	2.10E+00 - 2.00E+01	1.99E+01	Yes
gamma-BHC	4 / 6	4.40E+00 - 1.10E+02	2.10E+00 - 4.00E+01	1.55E+01	Yes
Carbazole	4 / 6	5.30E+01 - 5.50E+02	3.90E+02 - 2.40E+04	1.18E+03	Yes
alpha-Chlordane	1 / 6	1.90E+00 - 1.90E+00	2.10E+00 - 2.50E+02	2.67E+00	Yes
DDT	1 / 6	1.20E+01 - 4.40E+01	4.00E+00 - 5.00E+01	2.58E+01	Yes
Dibenzofuran	2 / 6	5.60E+01 - 1.80E+02	3.90E+02 - 2.40E+04	2.18E+03	Yes
Dieldrin	6 / 6	1.20E+01 - 3.40E+02	4.00E+00 - 4.50E+00	5.15E+01	Yes
Endosulfan I	6 / 6	8.20E+00 - 2.00E+02	2.10E+00 - 2.00E+01	2.29E+01	Yes
Endosulfan II	4 / 6	5.00E+00 - 5.40E+01	4.00E+00 - 4.30E+01	1.49E+01	Yes
Endosulfan sulfate	1 / 6	3.10E+01 - 3.10E+01	4.00E+00 - 4.30E+01	2.10E+01	Yes
Endrin	2 / 6	2.30E+00 - 3.20E+01	4.00E+00 - 4.30E+01	1.00E+01	Yes
Heptachlor	2 / 6	8.50E+00 - 9.20E+01	2.10E+00 - 2.20E+01	2.50E+01	Yes
Hexachlorobenzene	2 / 6	5.40E+01 - 3.00E+02	3.90E+02 - 2.40E+04	1.93E+02	Yes
2-Methylnaphthalene	1 / 6	8.20E+01 - 8.20E+01	3.90E+02 - 2.40E+04	1.64E+02	Yes
Naphthalene	5 / 6	5.20E+01 - 3.40E+02	3.90E+02 - 2.40E+04	9.65E+02	Yes
PAHs					
Acenaphthylene	6 / 6	8.00E+01 - 1.60E+03	3.90E+02 - 2.40E+04	9.46E+02	Yes
Anthracene	6 / 6	4.60E+01 - 2.50E+03	4.00E+02 - 4.50E+02	3.88E+02	Yes
Benzo(a)anthracene	6 / 6	5.60E+01 - 2.00E+04	4.00E+02 - 4.20E+02	2.16E+03	Yes
Benzo(a)pyrene	6 / 6	8.80E+01 - 1.90E+04	4.00E+02 - 4.20E+02	2.06E+03	Yes
Benzo(b and/or k)fluoranthene	6 / 6	1.80E+02 - 4.50E+04	4.00E+02 - 4.20E+02	4.96E+03	Yes
Benzo(g,h,i)perylene	5 / 6	6.40E+01 - 4.00E+03	3.90E+02 - 2.40E+04	1.43E+03	Yes
Chrysene	6 / 6	9.40E+01 - 2.30E+04	4.00E+02 - 4.20E+02	2.48E+03	Yes
Dibenzo(a,h)anthracene	6 / 6	5.00E+01 - 5.00E+03	4.00E+02 - 4.50E+02	6.45E+02	Yes
Fluoranthene	6 / 6	9.70E+01 - 3.90E+04	4.00E+02 - 4.20E+02	3.90E+03	Yes
Indeno(1,2,3-cd)pyrene	6 / 6	8.30E+01 - 1.30E+04	4.00E+02 - 4.20E+02	1.48E+03	Yes
Phenanthrene	6 / 6	4.60E+01 - 5.70E+03	4.00E+02 - 4.50E+02	7.38E+02	Yes
Pyrene	6 / 6	1.40E+02 - 3.70E+04	4.00E+02 - 4.20E+02	3.22E+03	Yes
Styrene	1 / 6	2.00E+00 - 7.00E+00	1.20E+01 - 1.40E+01	5.17E+00	Yes
1,1,1-Trichloroethane	5 / 6	4.00E+00 - 3.50E+01	1.30E+01 - 1.40E+01	1.27E+01	Yes
Xylenes (total)	2 / 6	2.00E+00 - 3.00E+00	1.20E+01 - 1.40E+01	5.17E+00	Yes
Inorganics					
Aluminum	6 / 6	4.30E+03 - 1.60E+04	-	1.14E+04	Yes
Arsenic	6 / 6	2.20E+00 - 1.20E+01	-	7.34E+00	Yes
Barium	6 / 6	4.00E+01 - 1.30E+02	-	1.01E+02	Yes
Beryllium	1 / 6	1.50E+00 - 1.50E+00	1.00E+00 - 2.00E+00	1.00E+00	Yes
Calcium	6 / 6	4.50E+02 - 2.30E+03	-	1.32E+03	No ^d
Chromium (total)	6 / 6	9.20E+00 - 8.60E+01	-	3.48E+01	Yes
Cobalt	6 / 6	1.30E+01 - 1.80E+01	5.00E+00 - 2.00E+01	1.19E+01	Yes
Copper	1 / 6	5.40E+01 - 5.40E+01	6.00E+00 - 5.00E+01	2.97E+01	Yes
Iron	6 / 6	7.80E+03 - 2.10E+04	-	1.76E+04	Yes
Lead	6 / 6	1.00E+01 - 7.40E+01	-	3.51E+01	Yes
Magnesium	6 / 6	3.00E+02 - 1.10E+03	-	7.48E+02	No ^d
Manganese	6 / 6	1.90E+02 - 2.00E+03	-	1.02E+03	Yes
Mercury	5 / 6	1.30E-01 - 4.20E-01	6.00E-02 - 2.00E-01	1.44E-01	Yes
Nickel	6 / 6	1.10E+01 - 2.70E+01	5.00E+00 - 9.00E+00	1.55E+01	Yes
Potassium	1 / 6	6.40E+02 - 6.40E+02	2.40E+02 - 8.30E+02	3.48E+02	No ^d
Selenium	2 / 6	1.40E+00 - 2.30E+00	6.40E-01 - 2.00E+00	1.46E+00	Yes
Vanadium	6 / 6	1.40E+01 - 2.60E+01	9.00E+00 - 9.00E+00	2.09E+01	Yes
Zinc	6 / 6	3.40E+01 - 1.40E+02	3.00E+01 - 4.00E+01	7.04E+01	Yes
Cyanide	1 / 6	6.60E-01 - 1.50E+00	5.50E-01 - 6.90E-01	8.27E-01	Yes

^a = Number of sampling locations at which the chemical was detected compared with the total number of sampling locations; duplicates at a location were averaged and considered as one sample.

^b = Range of detected concentrations was based on the raw data prior to averaging the duplicates at a location.

^c = Arithmetic mean was based on averaging detected values after averaging duplicates at a location.

^d = Essential nutrient and low toxicity (EPA Region 4, 1995b).

2.1.4 Surface Water Sampling Results

Surface water samples were collected in December 1994 at 8 locations. Seven of the samples were collected in Chattanooga Creek (including a background location), and 1 was collected in an unnamed tributary in the vicinity of the Tar Deposit Site. Surface water sampling locations are shown in Figure 2-1 and 2-2. The data summary for surface water is presented in Table 2-5.

2.1.5 Sediment Sampling Results

Sediment samples were collected at 9 locations. Seven of the samples were collected in Chattanooga Creek (including a background location), and 2 were collected in an unnamed tributary in the vicinity of the Tar Deposit Site. The sediment sampling locations correspond to the surface water sampling locations, with an additional sediment sample taken in the unnamed tributary by the Tar Deposit Site. Sediment sampling locations are shown in Figure 2-1 and 2-2. The data summary for sediment is presented in Table 2-6.

2.1.6 Clam Tissue Sampling Results

Asiatic clams (*Corbicula fluminea*) were collected in May of 1995 from 4 locations in Chattanooga Creek, including a background location. The tissue samples represent composites of approximately 100 to 180 clams per sampling location. Clam tissue sampling locations are shown in Figure 2-1 and 2-2. The data summary for clam tissue is presented in Table 2-7.

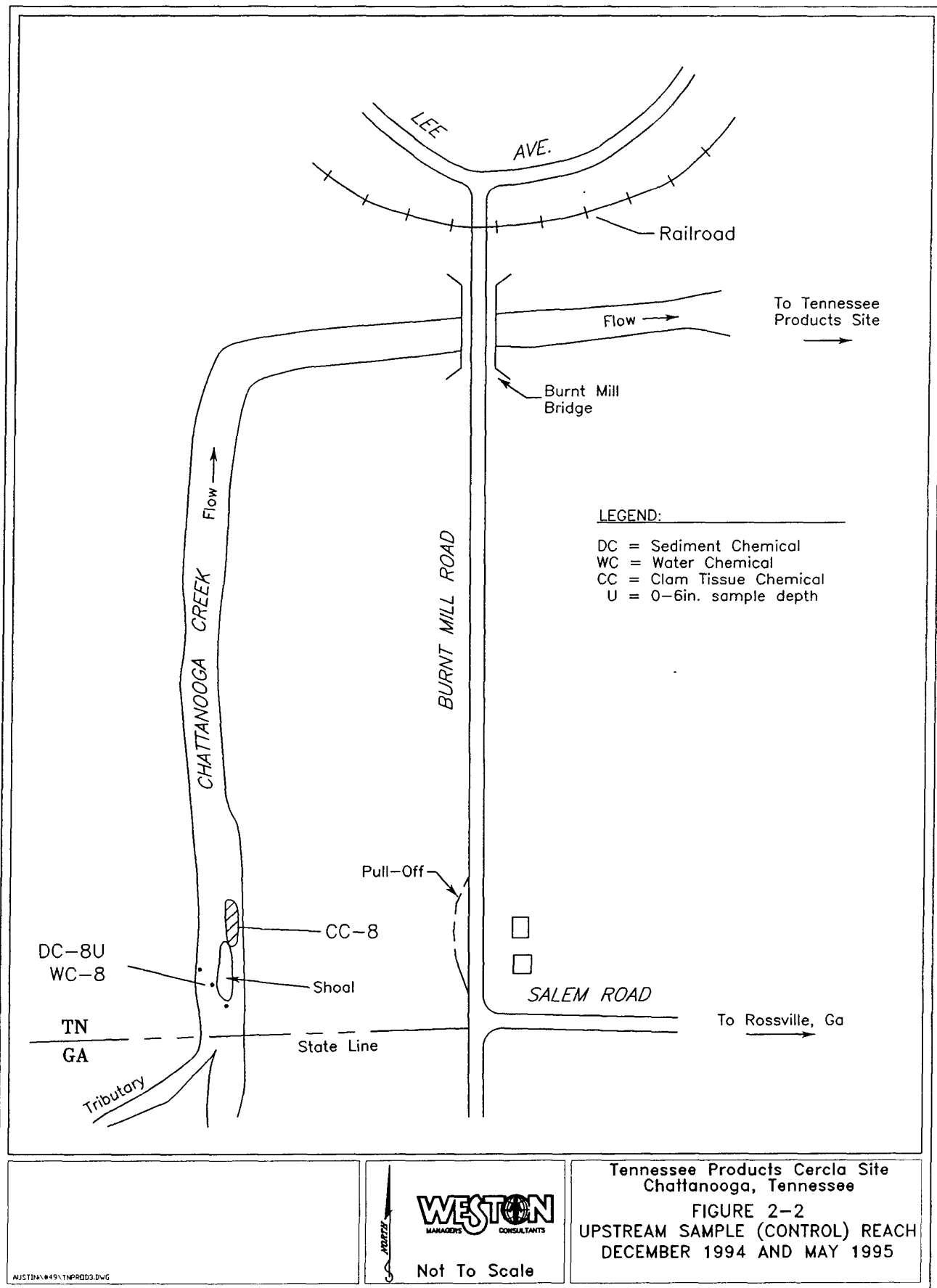


Table 2-5
Data Summary for Chemicals Detected in Chattanooga Creek Surface Water
Tennessee Products Site, Chattanooga, TN

Chemical	Frequency of Detection ^a	Range of Detected Concentrations ^b (Organics - µg/L) (Inorganics - mg/L)	Range of Detection Limits ^b (Organics - µg/L) (Inorganics - mg/L)	Mean Concentration ^c (Organics - µg/L) (Inorganics - mg/L)	Background Data ^d (Organics - µg/L) (Inorganics - mg/L)	EPA Region IV Screening Levels (Organics - µg/L) (Inorganics - mg/L)	Chemical Selected as COPC
<i>Organics</i>							
Bis(2-ethylhexyl)phthalate	1 / 7	1.30E+01 - 1.30E+01	1.00E+01 - 1.00E+01	1.30E+01	1.00E+01 U	< 3.00E-01	Yes
<i>Inorganics</i>							
Aluminum	7 / 7	1.70E-01 - 4.90E-01	-	2.70E-01	1.60E-01		Yes
Barium	7 / 7	2.40E-02 - 4.20E-02	-	2.76E-02	2.50E-02		Yes
Calcium	7 / 7	2.20E+01 - 3.50E+01	-	2.50E+01	2.10E+01		No ^e
Copper	1 / 7	4.10E-03 - 4.10E-03	2.00E-03 - 2.00E-03	4.10E-03	2.00E-03 U	9.60E-03	Yes ^f
Iron	7 / 7	3.10E-01 - 1.60E+00	-	5.40E-01	2.90E-01		Yes
Magnesium	7 / 7	3.10E+00 - 4.20E+00	-	3.89E+00	4.00E-03		No ^e
Manganese	7 / 7	7.10E-02 - 4.50E-01	-	1.26E-01	7.00E-02		Yes
Potassium	6 / 7	5.20E-01 - 7.50E-01	8.00E-01 - 8.00E-01	6.70E-01	5.40E-01		No ^e
Sodium	7 / 7	2.70E+00 - 6.80E+00	-	3.33E+00	2.40E+00		No ^e
Strontium	7 / 7	7.70E-02 - 8.60E-02	-	8.00E-02	7.60E-02		Yes
Titanium	6 / 7	2.00E-03 - 9.90E-03	2.00E-03 - 2.00E-03	4.03E-03	2.00E-03 U		Yes
Zinc	7 / 7	2.30E-03 - 1.80E-02	-	5.10E-03	2.60E-03	8.60E-02	Yes ^f

a = Number of sampling locations at which the chemical was detected compared with the total number of sampling locations; duplicates at a location were averaged and considered as one sample.

b = Range of detected concentrations was based on the raw data prior to averaging the duplicates at a location.

c = Arithmetic mean was based on averaging detected values after averaging duplicates at a location.

d = Based on sampling location WC-8.

e = Essential nutrient and low toxicity (EPA Region 4, 1995b).

f = Although the maximum detected concentration is below the screening level, this was kept as a contaminant of concern (COC) since this was selected as a COC for sediment.

U = nondetect

Table 2-6
Data Summary for Chemicals Detected in Chattanooga Creek Sediment
Tennessee Products Site, Chattanooga, TN

Chemical	Frequency of Detection ^a	Range of Detected Concentrations ^b (Organics - µg/kg) (Inorganics - mg/kg)	Range of Detection Limits ^b (Organics - µg/kg) (Inorganics - mg/kg)	Mean Concentration ^c (Organics - µg/kg) (Inorganics - mg/kg)	Background Data ^d (Organics - µg/kg) (Inorganics - mg/kg)	EPA Region IV Screening Levels (Organics - µg/kg) (Inorganics - mg/kg)	Chemical Selected as COPC
Organics							
Acetone	2 / 8	1.60E+03 - 1.80E+03	1.30E+01 - 1.40E+05	1.70E+03	6.30E+02 U		Yes
alpha - BHC	6 / 8	1.50E+02 - 4.30E+03	8.00E+01 - 1.00E+02	1.35E+03	4.70E+01 U		Yes
beta-BHC	6 / 7	3.80E+01 - 9.70E+02	1.00E+02 - 1.00E+02	3.41E+02	4.70E+01 U		Yes
delta-BHC	4 / 8	1.70E+01 - 2.00E+02	1.00E+02 - 4.00E+03	1.12E+02	4.70E+01 U		Yes
gamma-BHC	4 / 8	2.00E+01 - 7.20E+02	1.00E+02 - 2.20E+03	2.37E+02	4.70E+01 U	3.30E+00	Yes
Carbazole	4 / 8	5.80E+01 - 2.10E+05	9.00E+02 - 1.10E+04	5.32E+04	6.60E+03 U		Yes
Chlorobenzene	1 / 8	3.30E+03 - 3.30E+03	1.30E+01 - 1.90E+02	3.30E+03	6.30E+01 U		Yes
o-Chlorotoluene	1 / 6	1.00E+04 - 1.00E+04	4.90E+01 - 1.90E+02	1.00E+04	6.30E+01 U		Yes
p-Chlorotoluene	1 / 6	5.10E+03 - 5.10E+03	4.90E+01 - 1.90E+02	5.10E+03	6.30E+01 U		Yes
Dibenzofuran	4 / 8	8.60E+02 - 2.80E+05	4.30E+02 - 1.10E+04	7.11E+04	6.60E+03 U		Yes
1,2-Dichlorobenzene	1 / 6	1.70E+03 - 1.70E+03	4.90E+01 - 1.90E+02	1.70E+03	6.30E+01 U		Yes
1,4-Dichlorobenzene	1 / 6	2.50E+03 - 2.50E+03	4.90E+01 - 1.90E+02	2.50E+03	6.30E+01 U		Yes
Dieldrin	1 / 7	7.60E+01 - 7.60E+01	1.00E+02 - 4.00E+03	7.60E+01	4.70E+01 U	3.30E+00	Yes
Endosulfan I	1 / 8	3.90E+01 - 3.90E+01	1.20E+01 - 4.00E+03	3.90E+01	4.70E+01 U		Yes
Endosulfan II	1 / 8	3.00E+01 - 3.00E+01	2.30E+01 - 4.00E+03	3.00E+01	4.70E+01 U		Yes
Ethylbenzene	1 / 8	2.10E+03 - 2.10E+03	1.30E+01 - 1.90E+02	2.10E+03	6.30E+01 U		Yes
Heptachlor epoxide	1 / 8	2.20E+01 - 2.20E+01	1.20E+01 - 2.20E+03	2.20E+01	4.70E+01 U		Yes
Hexachlorobenzene	1 / 8	4.60E+01 - 4.60E+01	9.00E+02 - 1.30E+05	4.60E+01	6.60E+03 U		Yes
Methoxychlor	1 / 8	5.50E+01 - 5.50E+01	1.20E+02 - 8.70E+03	5.50E+01	7.40E+01 U		Yes
2-Methylnaphthalene	4 / 8	6.70E+02 - 4.80E+05	4.30E+02 - 1.10E+04	1.21E+05	6.60E+03 U	3.30E+02	Yes
(3- and/or 4-)Methylphenol	1 / 8	1.70E+02 - 1.70E+02	9.00E+02 - 1.30E+05	1.70E+02	6.60E+03 U		Yes
Naphthalene	6 / 8	9.50E+01 - 1.40E+06	9.00E+02 - 1.10E+04	2.37E+05	6.60E+03 U	3.30E+02	Yes
PAHs							
Acenaphthene	3 / 8	2.00E+03 - 3.20E+05	4.30E+02 - 1.10E+04	1.08E+05	6.60E+03 U	3.30E+02	Yes
Acenaphthylene	6 / 8	1.20E+02 - 5.10E+04	8.40E+03 - 1.10E+04	9.38E+03	6.60E+03 U	3.30E+02	Yes
Anthracene	6 / 8	3.50E+02 - 1.80E+05	9.00E+02 - 1.10E+04	3.30E+04	7.70E+02 J	3.30E+02	Yes
Benzo(a)anthracene	3 / 8	8.90E+02 - 7.90E+03	4.80E+03 - 1.30E+05	4.03E+03	4.10E+03 J	3.30E+02	Yes
Benzo(b and/or k) fluoranthene	8 / 8	1.20E+03 - 3.80E+05	-	5.62E+04	5.60E+03 J		Yes
Benzo(g,h,i)perylene	8 / 8	7.20E+02 - 2.30E+05	-	3.41E+04	3.50E+03 J		Yes
Benzo(a)pyrene	7 / 8	1.20E+03 - 2.50E+05	1.10E+04 - 1.10E+04	4.18E+04	3.50E+03 J	3.30E+02	Yes
Chrysene	4 / 8	1.00E+03 - 6.30E+03	4.80E+03 - 1.30E+05	3.05E+03	4.30E+03 J	3.30E+02	Yes
Dibenzo(a,h,)anthracene	7 / 8	3.10E+02 - 6.30E+04	1.10E+04 - 1.10E+04	1.06E+04	8.80E+02 J	3.30E+02	Yes
Fluoranthene	8 / 8	1.00E+03 - 6.70E+05	-	9.19E+04	9.80E+03	3.30E+02	Yes
Fluorene	4 / 8	1.20E+03 - 4.10E+05	4.30E+02 - 1.10E+04	1.05E+05	6.60E+03 U	3.30E+02	Yes
Indeno(1,2,3-cd)pyrene	8 / 8	8.40E+02 - 2.50E+05	-	3.69E+04	3.60E+03 J		Yes
Phenanthrene	7 / 8	1.90E+02 - 1.50E+06	1.10E+04 - 1.10E+04	2.20E+05	4.50E+03 J	3.30E+02	Yes
Pyrene	8 / 8	9.20E+02 - 5.10E+05	-	7.05E+04	7.50E+03	3.30E+02	Yes
Toluene	1 / 8	7.10E+03 - 7.10E+03	1.30E+01 - 1.90E+02	7.10E+03	6.30E+01 U		Yes
Xylene (total)	1 / 8	1.44E+04 - 1.44E+04	1.30E+01 - 1.90E+02	1.44E+04	6.30E+01 U		Yes

Table 2-6 (continued)
Data Summary for Chemicals Detected In Chattanooga Creek Sediment
Tennessee Products Site, Chattanooga, TN

Chemical	Frequency of Detection ^a	Range of Detected Concentrations ^b (Organics - µg/kg) (Inorganics - mg/kg)	Range of Detection Limits ^b (Organics - µg/kg) (Inorganics - mg/kg)	Mean Concentration ^c (Organics - µg/kg) (Inorganics - mg/kg)	Background Data ^d (Organics - µg/kg) (Inorganics - mg/kg)	EPA Region IV Screening Levels (Organics - µg/kg) (Inorganics - mg/kg)	Chemical Selected as COC
Inorganics							
Aluminum	8 / 8	2.90E+03 - 1.10E+04	-	6.60E+03	3.60E+03		Yes
Arsenic	7 / 8	2.30E+00 - 5.80E+00	5.00E+00 - 5.00E+00	4.17E+00	2.90E+00	7.24E+00	Yes ^e
Barium	8 / 8	3.10E+01 - 9.90E+01	-	6.06E+01	2.50E+01		Yes
Beryllium	2 / 8	5.80E-01 - 7.20E-01	5.00E-01 - 1.00E+00	6.50E-01	5.00E-01 U		Yes
Cadmium	1 / 8	4.80E-01 - 4.80E-01	2.30E-01 - 1.00E+00	4.80E-01	5.00E-01 U	1.00E+00	No ^f
Calcium	8 / 8	1.10E+03 - 7.20E+03	-	2.89E+03	9.80E+02		No ^g
Chromium	8 / 8	2.30E+01 - 4.80E+01	-	3.46E+01	6.70E+00	5.23E+01	No ^f
Cobalt	7 / 8	4.90E+00 - 1.50E+01	2.00E+01 - 2.00E+01	9.69E+00	4.70E+00		Yes
Copper	6 / 8	1.20E+01 - 8.00E+01	2.00E+01 - 2.00E+01	3.87E+01	7.60E+00	1.87E+01	Yes
Iron	8 / 8	7.50E+03 - 2.00E+04	-	1.26E+04	6.40E+03		Yes
Lead	8 / 8	1.90E+01 - 5.90E+01	-	3.43E+01	2.70E+01	3.02E+01	Yes
Magnesium	8 / 8	3.80E+02 - 1.90E+03	-	8.10E+02	4.40E+02		No ^g
Manganese	8 / 8	1.80E+02 - 1.30E+03	-	5.23E+02	1.90E+02		Yes
Mercury	3 / 8	1.20E-01 - 3.50E-01	2.00E-01 - 2.60E-01	2.00E-01	2.50E-01 U	1.30E-01	Yes
Molybdenum	1 / 6	1.80E+00 - 1.80E+00	1.00E+00 - 1.50E+00	1.80E+00	1.00E+00 U		Yes
Nickel	8 / 8	8.10E+00 - 3.40E+01	-	1.66E+01	8.80E+00	1.59E+01	Yes
Potassium	6 / 8	2.50E+02 - 7.60E+02	4.40E+02 - 5.50E+02	4.15E+02	3.60E+02		No ^g
Strontium	6 / 6	6.20E+00 - 1.90E+01	-	1.19E+01	4.40E+00		Yes
Titanium	6 / 6	4.70E+01 - 6.80E+01	-	5.38E+01	2.70E+01		Yes
Vanadium	8 / 8	7.50E+00 - 2.30E+01	-	1.39E+01	6.60E+00		Yes
Yttrium	6 / 6	3.40E+00 - 1.10E+01	-	5.87E+00	2.40E+00		Yes
Zinc	8 / 8	4.30E+01 - 1.90E+02	-	8.74E+01	4.60E+01	1.24E+02	Yes

a = Number of sampling locations at which the chemical was detected compared with the total number of sampling locations; duplicates at a location were averaged and considered as one sample.

b = Range of detected concentrations was based on the raw data prior to averaging the duplicates at a location.

c = Arithmetic mean was based on averaging detected values after averaging duplicates at a location.

d = Based on sampling location DC-8U.

e = Although the max detect concentration is below the screening level, this was kept as a contaminant of concern (COC) since this was selected as a COC for clams.

f = Max detect < Screening Level

g = Essential nutrient and low toxicity (EPA Region 4, 1995b).

U = Nondetect

J = Estimated Value

Table 2-7
Data Summary for Chemicals Detected in Clam Tissue
Tennessee Products Site, Chattanooga, TN

Chemical	Frequency of Detection ^a	Range of Detected Concentrations ^b (Organics - µg/kg) (Inorganics - mg/kg)	Range of Detection Limits ^b (Organics - µg/kg) (Inorganics - mg/kg)	Mean Concentration ^c (Organics - µg/kg) (Inorganics - mg/kg)	Background Data ^d (Organics - µg/kg) (Inorganics - mg/kg)	Chemical Selected as COPC
Organics						
PAHs						
Benzo(a)anthracene	1 / 3	1.80E-01 - 1.80E-01	1.70E+00 - 1.70E+00	1.80E-01	1.70E+00 U	Yes
Chrysene	1 / 3	1.80E-01 - 1.80E-01	1.70E+00 - 1.70E+00	1.80E-01	1.70E+00 U	Yes
Fluoranthene	2 / 3	2.40E-01 - 3.00E-01	1.70E+00 - 1.70E+00	2.70E-01	1.70E+00 U	Yes
Inorganics						
Aluminum	3 / 3	1.70E+02 - 1.80E+02	-	1.77E+02	2.10E+02	Yes
Arsenic	1 / 3	1.50E+00 - 1.50E+00	1.00E+00 - 2.00E+00	1.50E+00	1.00E+00 U	Yes
Barium	3 / 3	2.20E+00 - 2.40E+00	-	2.30E+00	3.00E+00	Yes
Cadmium	1 / 3	1.10E-01 - 1.10E-01	1.00E-01 - 1.50E-01	1.10E-01	1.10E-01	No ^e
Calcium	3 / 3	4.60E+02 - 5.60E+02	-	5.00E+02	4.40E+02	No ^e
Chromium (total)	3 / 3	6.70E-01 - 8.00E-01	-	7.50E-01	8.70E-01	No ^e
Cobalt	3 / 3	2.60E-01 - 3.50E-01	-	3.07E-01	3.40E-01	Yes
Copper	3 / 3	9.40E+00 - 1.40E+01	-	1.15E+01	6.90E+00	Yes
Iron	3 / 3	2.60E+02 - 3.00E+02	-	2.80E+02	3.60E+02	Yes
Magnesium	3 / 3	1.10E+02 - 1.20E+02	-	1.17E+02	1.10E+02	No ^e
Manganese	3 / 3	2.20E+01 - 2.50E+01	-	2.33E+01	2.90E+01	Yes
Mercury	3 / 3	2.00E-02 - 2.40E-02	-	2.23E-02	2.00E-02	Yes
Nickel	3 / 3	7.10E-01 - 7.60E-01	-	7.37E-01	9.90E-01	Yes
Potassium	3 / 3	2.50E+02 - 2.70E+02	-	2.63E+02	2.10E+02	No ^e
Selenium	3 / 3	7.40E-01 - 1.30E+00	-	1.01E+00	1.10E+00	Yes
Sodium	3 / 3	3.80E+02 - 4.10E+02	-	3.97E+02	3.50E+02	No ^e
Strontium	3 / 3	9.20E-01 - 1.20E+00	-	1.03E+00	9.30E-01	Yes
Titanium	3 / 3	1.00E+00 - 1.20E+00	-	1.10E+00	1.50E+00	Yes
Vanadium	3 / 3	1.80E-01 - 2.50E-01	-	2.13E-01	2.40E-01	Yes
Zinc	3 / 3	2.60E+01 - 3.50E+01	-	3.13E+01	2.40E+01	Yes

a = Number of sampling locations at which the chemical was detected compared with the total number of sampling locations; duplicates at a location were averaged and considered as one sample.

b = Range of detected concentrations was based on the raw data prior to averaging the duplicates at a location.

c = Arithmetic mean was based on averaging detected values after averaging duplicates at a location.

d = Based on sampling location CC-8.

e = Maximum detected concentration does not exceed background concentration, and this chemical was not selected as a COC in surface water or sediment.

f = Essential nutrient and low toxicity (EPA Region 4, 1995b).

U = Nondetect

2.1.7 Selection of Chemicals of Potential Concern

The objective of this step is to screen the available analytical data for the media of concern and identify the COPCs for the ecological risk assessment. The screening criteria that were used to select or eliminate COPCs are as follows:

- A chemical was not considered in the COPC selection for a medium if it was not detected in any sample from that medium.
- For surface waters and sediments, a chemical was excluded as a COPC for a medium if the range of detected concentrations did not exceed the EPA Region 4 ecological screening levels, and it was not selected as a COPC in other media of Chattanooga Creek (i.e., surface water, sediment, clams).
- There was a limited amount of background data for the site (one sample each for surface water, sediment, and clams). Thus, comparison to background was only considered for these media, and it was not used as a sole determinant in choosing COPCs. If the maximum detected site-related concentration was less than 2 times the concentration in background, it was excluded as a COPC, provided it was not selected as a COPC in the other media of Chattanooga Creek. Comparison to background was not considered for soils, since site-related background data were not available for soils (however, this is discussed in the uncertainty analysis in Section 6).
- Inorganic chemicals that are considered as essential nutrients (calcium, iron, potassium, magnesium, and sodium) with low toxicity were not evaluated as

Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

COPCs unless they were detected at unusually high concentrations (EPA Region 4, 1995b).

Based on these criteria, COPCs were selected by medium and are presented in Tables 2-1 through 2-7.

2.2 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The city of Chattanooga falls within what Kuchler (1964) has termed the Appalachian Oak Forest Association. The summits and upper slopes of Lookout Mountain, Missionary Ridge, and Hawkins Ridge, which bracket the city, are dominated by upland oaks, and to a lesser degree by various species of hickory. Relatively level low lying areas such as the Tennessee Products Site, however, come under the influence of the Tennessee River and Chattanooga Creek. Consequently the vegetational composition is more typical of that found within Mixed Bottomland Hardwood Associations.

Past land use history at the site, including logging, industrial activities, and urban development has created a mosaic of seral communities including species typical of pioneer, intermediate, and subclimax successional stages. By giving rise to these various successional stages it is highly likely that anthropogenic disturbances have actually increased the site's biodiversity above what it would have been without man's impact.

WESTON conducted a biological survey at the site in May 1995, which included an assessment of vegetation and vertebrates. The methods used for the vegetation surveys included walk-through surveys along transect lines, as well as careful visualized screening of unique habitats recognized as having the greatest potential for supporting rare, threatened, or endangered

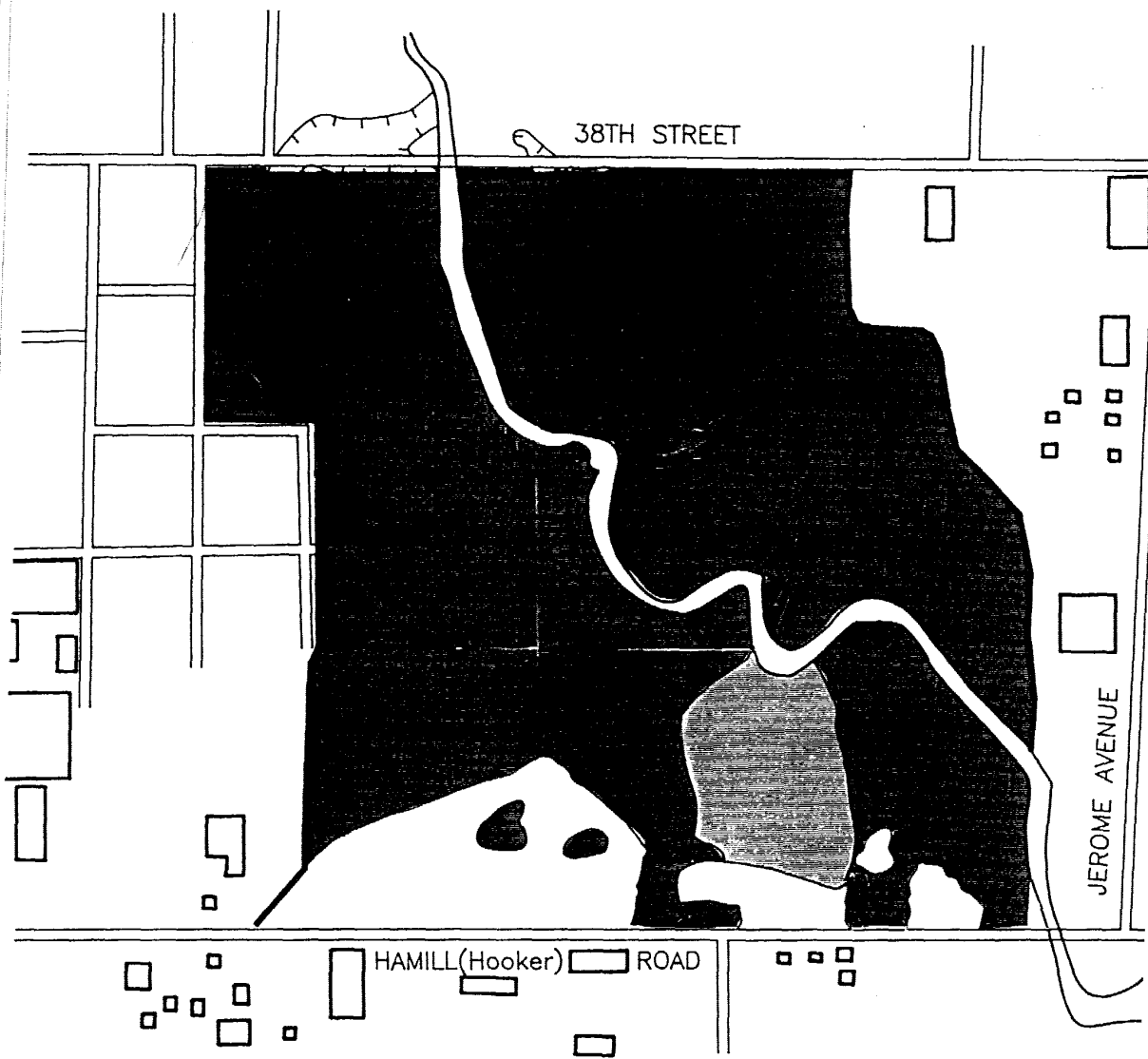
Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996




species. In herb-dominated communities, a 50 foot spacing between transect lines was used. Within more homogenous forested areas, transect spacing was increased to 200 feet. The vertebrate surveys were performed concurrently with the floristic investigations, and consisted of systematically examining each habitat type for species that were present. Bird species were identified by sight and song/call. Unlike plants and avifauna which are usually conspicuous and readily observed, many vertebrate species, by virtue of their secretive nature, nocturnal habits, small size, etc. are extremely difficult to inventory. Thus, a combined methodology was developed to make use of both on-site observations and a literature review. The presence of an animal was considered confirmed when an individual was observed directly or when indirect "signs" of a species such as nests, tracks, rubbings, and scat were in evidence. An expanded list of fauna likely to occur within the floodplain was developed by assessing habitat availability and comparing that to the habitat preference of each taxon known to inhabit the Ridge and Valley Physiographic Province in southeastern Tennessee. Standard reference works were used in this effort.

Three predominant community or habitat types were identified during the survey. Together these types encompass the full range of successional development present at the site, and include: an early successional/ruderal community, a recently clearcut wetland community, and a riparian forest community. The various taxa associated with each community type are summarized in the following subsections and are portrayed in Figure 2-3.

2.2.1 Early Successional/Ruderal Community

The early successional/ruderal community type occurs within areas that have undergone recent disturbance. It is confined exclusively to the southern end of the study site adjacent to Hamill and Hooker roads. The type is most often associated with vacant industrial properties but



-  = Riparian Forest Community
-  = Early Successional Ruderal Community
-  = Clearcut Wetland Community



Not To Scale

Tennessee Products Cercla Site
Chattanooga, Tennessee

FIGURE 2-3
HABITAT MAP

Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

occasionally occurs in the vicinity of old abandoned home sites. It is also rarely encountered in areas where the floodplain of Chattanooga Creek have been recently filled to create additional usable commercial property. The early successional/ruderal community covers about 3 hectares (7.5 acres) or approximately 5.7 percent of the entire study area (Figure 2-3).

Of the 255 species of plants identified site-wide, 137 (53.7 percent) occur within the early successional/ruderal community (Table B-1, See Appendix B). Seventy-five of these, or 29.4 percent of the flora, are unique to the type. Although occasional woody vines, shrubs, and tree seedlings and saplings have encroached into the open areas, greater than 70 percent of the plant species are herbaceous. Exotics (non-natives) are also well represented, constituting over 42 percent of the taxa extant within the community.

From the standpoint of both cover and frequency the most dominant elements in the flora are several exotic members of the pea and parsley families (Table B-2). These include yellow and white sweetclovers (*Melilotus officinalis*, *M. alba*), white clover (*Trifolium repens*), sericea lespedeza (*Lespedeza cuneata*), and Queen Anne's lace (*Daucus carota*). Equally important are two native aster family members; daisy fleabane (*Erigeron annuus*) and common ragweed (*Ambrosia artemisiifolia*). Unique to the type are several species of non-native trees including European white poplar (*Populus alba*) and southern magnolia (*Magnolia grandiflora*). These specimens were undoubtedly planted around old home sites. Such too is the case with cherrybark oak (*Quercus falcata* var. *pagodaefolia*). This inhabitant of bottomland forests of the southeastern coastal plain and lower Mississippi River valley appears to have escaped and is now becoming naturalized in moist areas throughout the study site.

Twenty-two bird species were observed within the early successional/ruderal type (Table B-3). This was the lowest cumulative total of any of the three communities investigated. Most were

Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

common songbirds such as cardinal (*Cardinalis cardinalis*), carolina chickadee (*Parus carolinensis*), mockingbird (*Mimus polyglottos*), towhee (*Pipilo erythrophthalmus*), robin (*Turdus migratorius*), and song sparrow (*Melospiza melodia*). A single raptor species was also noted. During the course of the field survey a number of red-tailed hawks (*Buteo jamaicensis*) were seen either perch hunting or circling over the site. The relatively low diversity may be explained by the somewhat limited amount of protective cover available in this herb dominated area. It was also the area which appeared most prone to human disturbance from automobile traffic and industrial activity.

While habitat does exist to harbor a number of different small mammals, none were observed directly (Table B-4). One woodchuck (*Marmota monax*) burrow was located near the eastern boundary of the early successional tract and droppings from eastern cottontail rabbit (*Sylvilagus floridanus*) were found scattered throughout. Rabbit droppings were especially plentiful in and around blackberry and dewberry (*Rubus* spp.) thickets.

Reptiles and amphibians were similarly sparse and difficult to detect (Table B-5). Apart from several broadhead skinks (*Eumeces laticeps*) scampering across debris piles, no other members of these classes of animals were observed.

2.2.2 Clearcut Wetland Community

At an estimated 5.4 hectares (13 acres), the clearcut wetland community covers approximately 10% of the total study area. It is located about midway along the sites southern boundary just north of the intersection of Wilson Road and Hamill Road (Figure 2-3). The northeast corner of the type lies adjacent to Hamill Road Dump No. 2 and the northwestern boundary abuts Hamill Road Dump No. 3 (Barnett, 1994). Such close proximity to these pollution sources

Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

suggests that this is an area that has a high likelihood of being exposed to metals, organics and a variety of other contaminants of concern (Dynamac, 1992; EPA, 1992b).

Prior to logging operations, this locale was part of the riparian forest which lies adjacent to Chattanooga Creek. The nearly complete removal of woody overstory vegetation within the last five years has caused both a reversion to an herb-dominated pioneer community and also a temporary reduction in the amount of natural evapotranspiration taking place. Consequently, soil moisture levels have been elevated to the point where many of the plant species that dominate the area are hydrophytes. Of the 105 species of plants tallied during the community survey, 79 (75.2 percent) may be considered adapted to growing in substrates that are, at least periodically, deficient in oxygen as a result of excessive water content (Table B-1)(Reed 1988).

Common examples of such species include fox sedge (*Carex vulpinoidea*), Frank's sedge (*C. frankii*), marsh flatsedge (*Cyperus pseudovegetus*), straw-color flatsedge (*Cyperus strigosus*), spike-rush (*Eleocharis obtusa*), path rush (*Juncus tenuis*), hedgehyssop (*Gratiola* sp.), thoroughwort (*Eupatorium serotinum*), and clustered dock (*Rumex conglomeratus*). Although poorly represented in terms of areal cover, residual woody taxa constituted more than a quarter of all plant species present within the type. These included species such as American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), river birch (*Betula nigra*), red maple (*Acer rubrum*), black willow (*Salix nigra*), and Chinese privet (*Ligustrum sinense*) (Table B-2).

Despite its limited areal extent, the clearcut wetland community was found to support the most diverse avian population. Of the 50 birds discovered sitewide, 40 (80 percent) were found at this locale (Table B-3). Fourteen of these were unique and were comprised largely of piscivorous and insectivorous species favoring wetland or open water habitats. Examples include the great blue heron (*Ardea herodias*), green heron (*Butorides striatus*), yellow-crowned night-

heron (*Nycticorax violaceus*), swamp sparrow (*Melospiza georgiana*), rough-winged swallow (*Stelgidopteryx ruficollis*), barn swallow (*Hirundo rustica*), yellow-throated vireo (*Vireo flavifrons*), eastern phoebe (*Sayornis phoebe*), and blue-gray gnatcatcher (*Poliophtila caerulea*). The type also supported two raptors, the red-tailed hawk and barred owl (*Strix varia*). Each of these were observed as they perched in residual trees not taken during logging.

Very few small mammals or reptiles and amphibians were observed directly (Tables B-4, B-5). Several gray squirrels (*Sciurus carolinensis*) were seen foraging within the woodland borders adjoining the clearcut and a single female box turtle (*Terrapene carolina*) was spotted as it crossed a sedge-dominated portion of the community. A number of eastern narrowmouth toads (*Gastrophryne carolinensis*) were heard calling from various stations around a small seasonal pond located near the western boundary clearcut (vicinity of former Hamill Road Dump No. 3). Raccoon (*Procyon lotor*) and opossum (*Didelphis marsupialis*) tracks were abundant throughout. It was assumed that the occasional remnants of burrowing crayfish shells encountered in the area were consumed by either of these opportunistic scavengers.

2.2.3 Riparian Forest Community

Riparian forests occupy by far the largest portion of the study site, nearly 45 hectares (111 acres), representing 84% of the study area (Figure 2-3). This community reaches its best development on primary and secondary terraces of Chattanooga Creek where nutrient availability is likely to be at a maximum and where there is a readily available supply of soil moisture. Periodic flooding within the area is indicated by the widespread occurrence of drift lines, sediment deposits and floodplain depressions. Previous investigations by EPA (1992c) have conditionally classified about one-third of the land between Hamill/Hooker roads and 38th Street as palustrine forested wetlands.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

Overstory trees with the riparian forest typically range from 30-75 centimeters (cm) in diameter at breast height (dbh) and attain heights of 20-30 meters (m). The largest specimens however may reach 115 cm dbh. Such individuals are estimated to be well over 150 years old. While most stands appear structurally and compositionally mid-successional, there are many scattered even-aged occurrences. These are likely the result of disturbances associated with past industrial and residential development, selective logging, re-alignment of Chattanooga Creek, and possibly catastrophic floods.

The vegetation survey identified 111 plant species that occur within this community (Table B-1). This number is second only to the early successional type in terms of vegetative diversity. Overall makeup is 38.7 percent herbaceous and 61.3 percent woody. Fifty-five of the plants are unique to the community. Most of these are woody mesophytes and include regionally common species such as silver maple (*Acer saccharinum*), sugar maple (*Acer saccharum*), sycamore (*Platanus occidentalis*), yellow-poplar (*Liriodendron tulipifera*), and American hornbeam (*Carpinus caroliniana*).

Overstory diversity is moderately high at 39 taxa (Table B-2). More than one third of all arborescent species, however, fall within only three genera: *Quercus* (oak) with six species, *Acer* (maple) with four species, and *Carya* (hickory) with three species. The most dominant entities in approximate order of abundance are green ash, American elm, sweetgum (*Liquidambar styraciflua*), red maple, boxelder (*Acer negundo*), and hackberry (*Celtis occidentalis*). The existence of shellbark hickory (*Carya laciniata*) and overcup oak (*Quercus lyrata*) in this vicinity is notable since both trees exist within outlier populations near the extreme edge of their natural ranges. The free establishment of cherrybark oak within the riparian forest is also worthy of note for this southeastern coastal plain endemic.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

For the most part, woody understory composition closely follows that found in the canopy. In terms of numerical abundance and coverage, boxelder, red maple, and American elm are the most dominant. In the south and western portion of the study area, though, Chinese privet (*Ligustrum sinense*) has become firmly established and in many instances this escaped ornamental shrub forms nearly impenetrable thickets. In still other areas, particularly in the vicinity of shaded floodplain depressions, a unique association of buttonbush (*Cephalanthus occidentalis*), stiff dogwood (*Cornus foemina*), and deciduous holly (*Ilex decidua*) predominate.

The riparian forest supports 27 confirmed species of birds including several found nowhere else on site (Table B-3). These include, among others, waterthrush (*Seiurus* sp.), hermit thrush (*Catharus guttatus*), prothonotary warbler (*Protonotaria citrea*), and chestnut-sided warbler (*Dendroica pensylvanica*). Other taxa confirmed via direct sighting or sign are black rat snake (*Elaphe obsoleta*), raccoon, beaver (*Castor canadensis*), and gray squirrel (Tables B-4, B-5). The discovery of numerous muskrat (*Ondatra zibethica*) shell middens along streamside embankments is noteworthy since it provides direct evidence of the consumption of Asiatic clams from the main stem of Chattanooga Creek (Tables B-4, B-5).

2.3 Identification of Exposure Pathways

An exposure pathway describes the course a chemical takes from its source to an ecological receptor. An exposure pathway generally consists of 4 elements: 1) a source and mechanism of chemical release, 2) a retention or transport medium, 3) a point of contact with the receptor, and 4) and an exposure route (e.g., ingestion) at the point of contact. The following is a discussion, by medium, of the potential ecological exposure pathways that exist at the Tennessee Products Site.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

2.3.1 Surface Water/Sediment

Chattanooga Creek is the recipient of coal-tar contamination from the Tennessee Products Site. Contaminants have entered the creek by past disposal of coal tar directly into the creek. In addition, there are areas of contaminated soils near the creek. Contaminants in soils may enter the creek through surface water runoff, where they may partition to sediments, and may be transported downstream. Chattanooga Creek provides a drinking water and food source for terrestrial receptors, as well as habitat for aquatic receptors. Terrestrial receptors may be exposed through the ingestion of surface water, and the ingestion of aquatic organisms that have bioaccumulated contaminants. Aquatic organisms are potentially exposed to contaminants in their environment through several routes, including uptake of water across the gills, dermal contact with water or sediments, ingestion of prey or forage that has bioconcentrated contaminants, and incidental ingestion of sediments. Exposure of aquatic fauna is continuous and occurs through several routes simultaneously. Exposure of aquatic flora may occur through root uptake, as well as uptake across leaf surfaces.

2.3.2 Soil

Mammals and birds may be exposed to chemicals in soil through the ingestion of soil-dwelling invertebrates, through the ingestion of plants that have taken up contaminants from soil, or through the incidental ingestion of soil while feeding, burrowing, or preening. Inhalation of vapor-phase and particle-bound chemicals that are present in the ambient air can also contribute to the daily dose since COPCs include organic chemicals that volatilize, as well as non-volatile organics and metals that sorb to soil particles. Dermal exposure is another exposure pathway that may contribute to risk, especially for burrowing organisms. Soil invertebrates are continuously and directly exposed to chemical contaminants in their environment through

Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

ingestion and dermal absorption. Terrestrial vegetation can be exposed to chemicals in surface soil through uptake via plant roots and through leaf uptake of vapor phase chemicals.

2.3.3 Groundwater

Ecological organisms are not exposed directly to groundwater. However, groundwater may impact surface water quality, since groundwater from the upper zone of saturation may discharge to Chattanooga Creek. Since data have been collected from Chattanooga Creek, any chemical contribution from groundwater is reflected in these surface water and sediment data. Thus, the groundwater exposure pathway is accounted for in the evaluation of surface waters.

2.4 SELECTION OF ASSESSMENT AND MEASUREMENT ENDPOINTS

Given the potential for ecological impacts to occur at the site, a set of assessment endpoints is proposed to achieve the goals of the environmental assessment. The assessment endpoints represent statements or goals concerning the environmental values that are to be protected (EPA,1992a). For each of the designated assessment endpoints, one or more measurement endpoints are selected based on their ability to integrate modeled, field, or laboratory data with the individual assessment endpoint.

Assessment endpoints are the foundation of the ecological risk assessment since they provide the basis for evaluating a site and the extent of contamination, and for assessing the potential risks to ecological receptors. Several criteria that an assessment endpoint should satisfy have been proposed (Suter, 1989; 1990; 1993):

- Societal relevance
- Biological relevance

Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

- Unambiguous operational definition
- Capability of measurement
- Susceptibility to hazard

Because the habitats and receptors at a site are unique, there is no standard list of assessment endpoints. Population abundance, community structure, or ecosystem productivity are typically evaluated. Knowing what the valuable ecological receptors are in the vicinity of the site, provides a basis for selecting both the assessment and measurement endpoints.

Measurement endpoints are the measurable environmental characteristics that are predictive of the selected assessment endpoint. Measurement endpoints approximate, represent, or predict conditions at a site (Maughan, 1993) and link the conditions to the assessment endpoints. The criteria considered in the selection of measurement endpoints include:

- Readily measured or evaluated
- Corresponds to or is predictive of an assessment endpoint
- Appropriate to the scale of the site, exposure pathways, and temporal dynamics
- Low natural variability
- Rapidly responding and sensitive to receptors

For the evaluation proposed at this site, evaluation of appropriate measurement endpoints will involve the use of benchmark and literature toxicity values that satisfy many of the listed criteria, as well as the use of site-specific field and laboratory studies. Several scenarios and/or receptors will be used to evaluate each impacted media at the site to ensure that potential impacts of contaminants from each media are thoroughly evaluated. Using the previously mentioned criteria and guidance, ecological endpoints for the Tennessee Products Site are presented in Table 2-8.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

Table 2-8

**Ecological Assessment and Measurement Endpoints
Tennessee Products Site
Chattanooga, TN**

Assessment Endpoints	Measurement Endpoints
Survival, growth, and reproduction of mammals and birds that feed in Chattanooga Creek, or in the vicinity of the Tar Dump and Hamill Road Dump #3.	Estimated chemical doses, and comparison to literature-based toxicity data (primarily survival and reproduction-related effects).
	Chemical bioconcentration into tissues, estimated (plant, earthworm,) and measured (clam) to support dose estimates.
Survival and growth of plants at the Tar Dump and Hamill Road Dump #3.	Direct observations of phytotoxic signs (e.g., necrosis and chlorosis).
	Chemical concentrations in soil, and comparison with literature-based toxicity data.
Survival of soil invertebrates at the Tar Dump and Hamill Road Dump #3.	Survival of earthworms exposed to Tar Dump and Hamill Road Dump #3 soils in a 14-day static toxicity test.
Survival, growth, and reproduction of aquatic life in Chattanooga Creek.	Survival and reproduction of daphnia exposed to sediments of Chattanooga Creek in a 7-day chronic toxicity test.
	Light production in luminescent bacteria exposed to sediment pore water from Chattanooga Creek in the Microtox test.
	Chemical concentrations in surface water, and comparison to EPA Region 4 Freshwater Surface Water Screening Values.
	Chemical concentrations in sediments, and comparison to sediment guidance values (i.e., EPA Region 4, Ontario Ministry of the Environment, U.S. EPA).

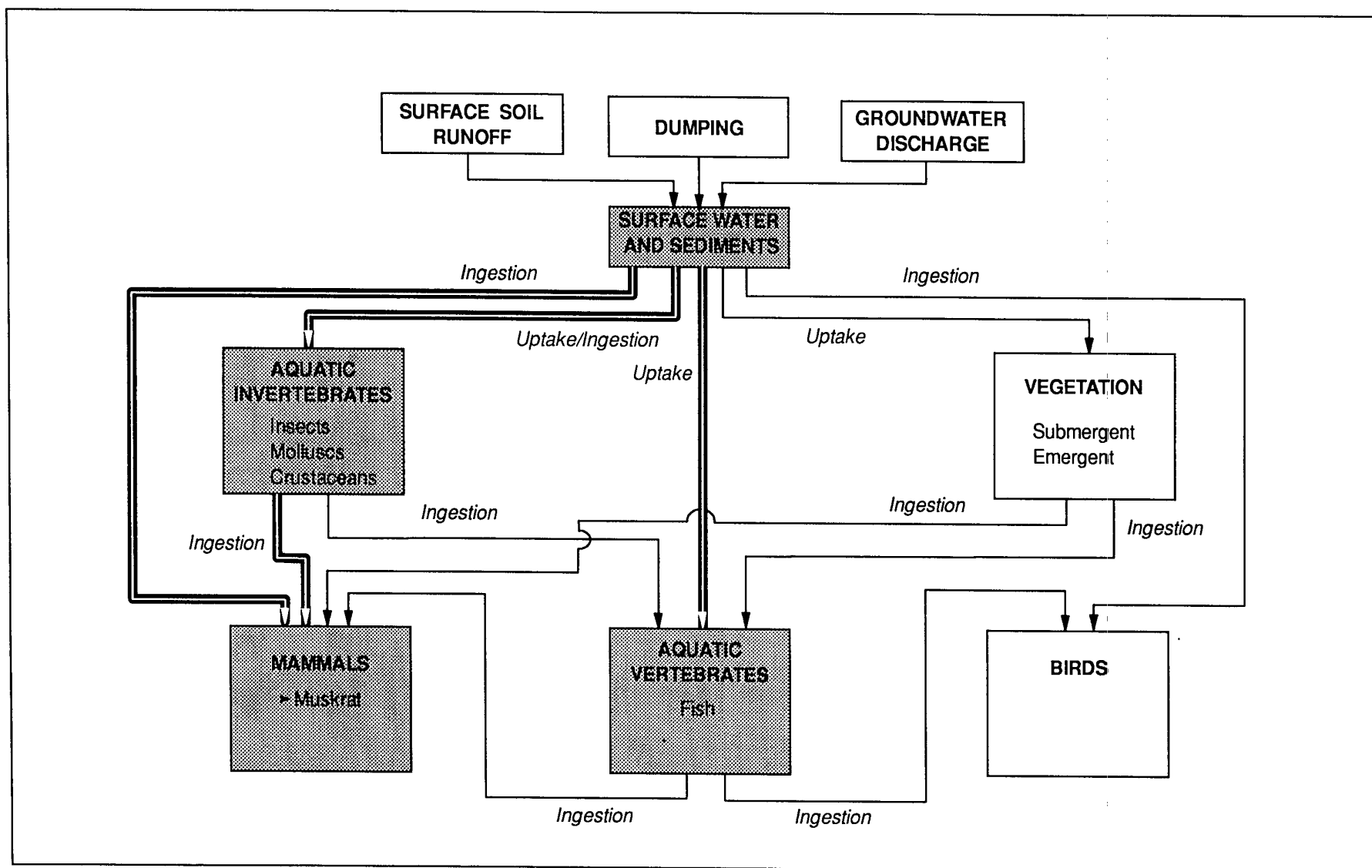
Ecological Risk Assessment
Tennessee Products Site
Section: Section 2
Revision: 0
Date: April 1996

2.5 SITE CONCEPTUAL MODEL



The primary objective of problem formulation is the development of a site conceptual model, which serves to define how contamination might affect ecosystems at the site (Norton et al., 1992). Information provided by the ecological setting characterization, selection of preliminary COPCs, receptor species, exposure pathways, and endpoints were integrated into a model that describes how individual components of the ecosystem may interact with site-related contamination. The site conceptual model is presented in Figures 2-4 and 2-5 for aquatic and terrestrial receptors, respectively. According to the site conceptual model, the following exposure scenarios will be included in the ecological risk assessment for the site:

2.5.1 Aquatic Habitat

- Aquatic life (invertebrates and vertebrates) may be exposed to chemicals through ingestion of surface water, ingestion of sediments, ingestion of food, and through passage of water over the gills. Aquatic plants may be exposed to chemicals through the water column or uptake through roots in sediments. Potential toxicity will be evaluated through site-specific sediment toxicity tests, Microtox tests, and by comparing exposure concentrations (i.e., surface water and sediment concentrations) to available media-specific criteria and/or guidelines.
- A secondary consumer (omnivore) hazard quotient evaluation for a mammalian species, where cumulative oral exposure (ingestion of clams and surface water) will be compared with reference toxicity values.

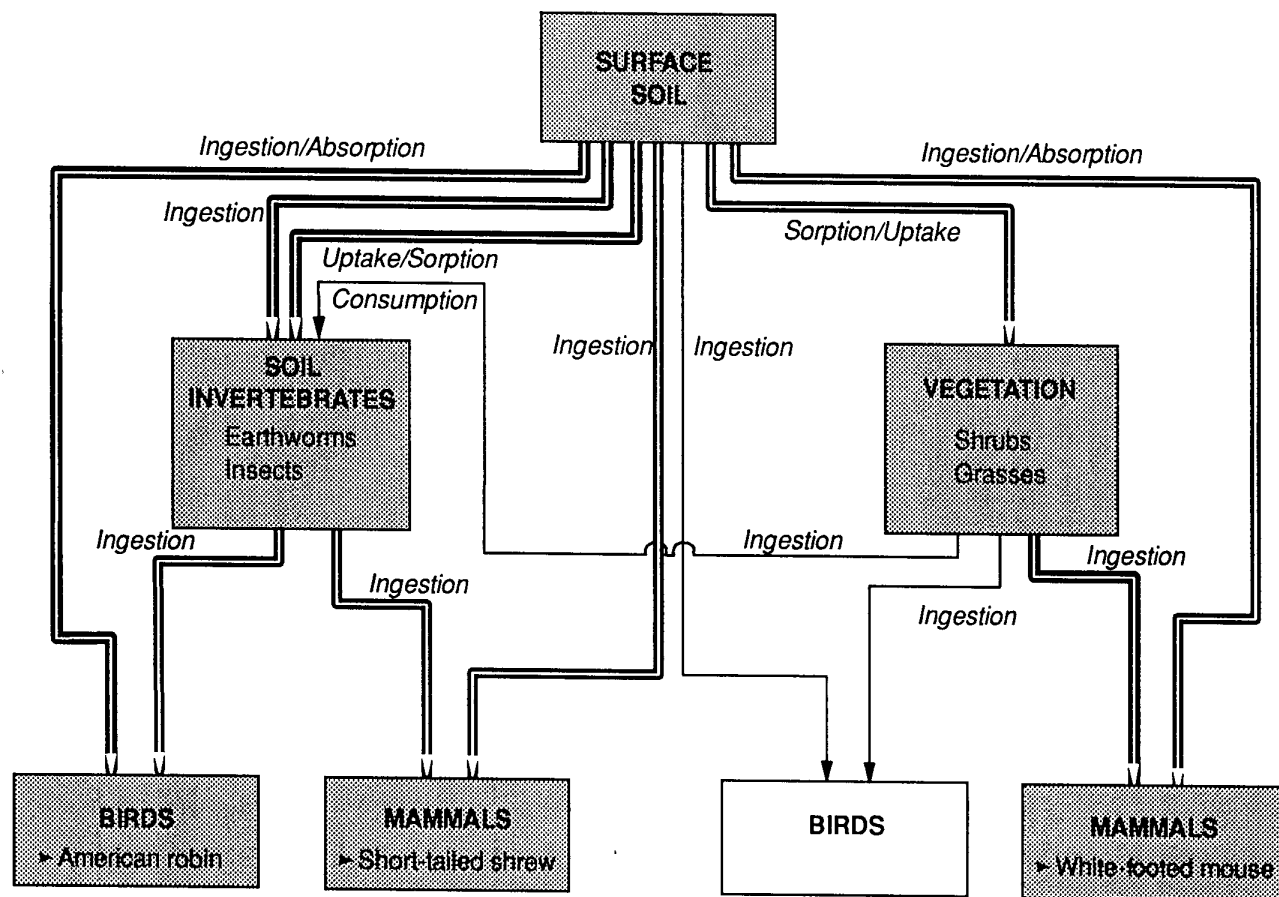


LEGEND

- Indicator species
-  Pathway evaluated
-  Prime areas of consideration

TENNESSEE PRODUCTS SITE
CHATTANOOGA, TENNESSEE

FIGURE 2-4
SITE CONCEPTUAL MODEL FOR THE
AQUATIC ECOSYSTEM



LEGEND

- Indicator species
- Pathway evaluated
- ▨ Prime areas of consideration

TENNESSEE PRODUCTS SITE
CHATTANOOGA, TENNESSEE

FIGURE 2-5
SITE CONCEPTUAL MODEL FOR THE
TERRESTRIAL ECOSYSTEM

2.5.2 Terrestrial Habitat

- A primary consumer (herbivore) hazard quotient evaluation for a mammalian species where cumulative oral exposure (ingestion of vegetation and incidental ingestion of soil) will be compared with reference toxicity values.
- A secondary consumer (carnivore/insectivore) hazard quotient evaluation for an avian and mammalian species where cumulative oral exposure (ingestion of invertebrates and incidental ingestion of soil) will be compared with reference toxicity values.
- A phytotoxicity evaluation where measured soil concentrations will be compared to plant toxicity data obtained from the literature.
- An evaluation of toxicity to soil fauna, by reviewing results of site-specific earthworm toxicity tests.

SECTION 3

EXPOSURE CHARACTERIZATION

The objectives of the exposure assessment are to:

- Identify habitats that have received or may receive chemicals from the site.
- Identify the plants, aquatic life, and terrestrial wildlife that may be potentially exposed to the chemicals of potential concern.
- Select indicator species/communities.
- Identify significant pathways/routes by which indicator species are potentially exposed.
- Predict exposure doses for selected indicator species.

In characterizing ecological exposure, the potential magnitude and frequency by which ecological receptors are exposed to chemicals of potential concern are evaluated. In addition, the characterization evaluates all routes of exposure (e.g., soil ingestion, plant ingestion) by which species inhabiting impacted areas may be exposed.

3.1 SELECTION OF INDICATOR SPECIAL/COMMUNITIES AND PATHWAYS OF EXPOSURE

This subsection presents the basis for the selection of indicator species and communities for evaluation in this assessment. In addition, exposure pathways are selected for each of the indicator species based on the assessment of the habitat types and the known chemical distributions at the site. All exposure pathways that are of little or no concern based on the

analysis of site characteristics are eliminated. Emphasis is given to those pathways and species considered critical to the evaluation of ecological risk at the site.

The principal criteria used to select appropriate indicator species include:

- Species that occur on the site.
- Species that are threatened, endangered, or of special concern.
- Species that are critical to the structure and function of the particular ecosystem they inhabit.
- Species that serve as indicators of an important change in the ecosystem.
- Species that have a realistic and significant potential for exposure.
- Species for which sufficient exposure and/or toxicity data are available for evaluation.

Even though indicator species are selected for evaluation in the risk assessment, these species also represent the exposure that similar species with comparable feeding habits may be receiving, and thus, serve as surrogate species.

Factors that have gone into the exposure pathway selection process include:

- Local topography
- Local land and water use
- Site-specific habitat conditions
- Surrounding terrestrial and aquatic habitat
- Review of contaminant migration
- Persistence and mobility of migrating pollutants

The subsections that follow discuss the justification for the selection of indicator species and communities, as well as the selection of potential exposure routes.

3.1.1 Aquatic Life

Aquatic life that inhabits Chattanooga Creek may be exposed to chemicals of potential concern in surface water and sediment. Potential exposure to the aquatic community was assessed by comparing media concentrations to media-specific guidelines and criteria, as well as by conducting site-specific toxicity tests. Specifically, the assessment of potential effects on aquatic life from chemicals of concern in surface waters was performed by comparing measured surface water concentrations with EPA Region 4 Freshwater Surface Water Screening Values. A number of these values are based on EPA's ambient water quality criteria (AWQC) for the protection of aquatic life. The AWQC are developed to protect 95% of all aquatic life, including fish, aquatic invertebrates, and plants, where data are available. Thus, selection of individual indicator aquatic species is not warranted.

In order to evaluate the potential effects of chemicals in sediments to benthic organisms, site-specific bulk sediment toxicity tests were conducted using *Ceriodaphnia*. In addition, Microtox tests were conducting on sediment pore water. Chemical concentrations in sediment were also compared with EPA Region 4 Sediment Effect Values, Ontario Ministry of the Environment Lowest Effect Levels, and EPA's sediment criteria.

3.1.2 Terrestrial Wildlife

In this assessment, it is assumed that exposure of terrestrial wildlife to the chemicals of potential concern occurs primarily when the animals feed in those areas affected by site contamination.

Avian and mammalian species with the greatest potential for exposure were selected for evaluation. Species selected were representative of the principal habitat types present at the tar dump areas that were sampled at the site. In addition, species were selected that represented a range of feeding relationships within these habitats. Although wildlife present at the Tennessee Products Site may be exposed to the chemicals of potential concern through routes other than ingestion (i.e., dermal absorption and inhalation), there is little scientific information available with which to assess these types of exposures. Therefore, these routes of exposure will not be evaluated in this assessment.

Mammalian Species

A list of mammalian species known or likely to occur at the Tennessee Products Site is provided in Table B-4 (See Appendix B). From this list, three species were chosen for evaluation. The Northern short-tailed shrew (*Blarina brevicauda*) was selected as an indicator mammalian species for numerous reasons, including its almost exclusive insectivorous feeding habits, its limited home range (0.5 to 1.0 acre) (Burt and Grossenheider, 1980; Merritt, 1987), and its burrowing habits. The short-tailed shrew is an inhabitant of forests, grasslands, marshes, and brushy areas (Merritt, 1987). Thus, the site is expected to provide adequate habitat for the shrew. In addition, the shrew is representative of the small mammal community that exists at the site. The shrew was evaluated for exposure to chemicals in soils through the ingestion of soil invertebrates (i.e., earthworms) that may accumulate chemicals from their environment as well as through the incidental ingestion of soils while feeding, burrowing, and preening.

The white-footed mouse (*Peromyscus leucopus*) was also evaluated as an indicator species. The white-footed mouse was chosen due to its herbivorous diet, its limited home range (0.1 to 2.5 acres) (Burt and Grossenheider, 1980; Merritt, 1987), and because the site contains suitable habitat for this mouse. The white-footed mouse is most abundant in habitat that includes a

Ecological Risk Assessment
Tennessee Products Site
Section: Section 3
Revision: 0
Date: April 1996

canopy, such as brushy field and deciduous woodlots (EPA, 1993a). The affected terrestrial habitats investigated at the Tennessee Products Site include both brushy and wooded areas. Both these areas on the site are expected to provide adequate habitat for the white-footed mouse. The white-footed mouse was evaluated for exposure to chemicals through the ingestion of vegetation that may accumulate chemicals from soil, as well as through the incidental ingestion of soils while feeding, burrowing, and preening.

The muskrat (*Ondatra zibethicus*) was chosen as a target species, since they are known to feed on clams in Chattanooga Creek. During site activities, clams were observed to be abundant in the creek, and concentrated areas of clam shells were found along the banks of the creek, indicating that muskrats had been feeding on them. Since clams are stationary benthic organisms, they would be expected to be a good indicator of contaminant uptake from the sediments. The home range of the muskrat extends from 33 to 600 feet of stream bank (Merritt, 1987). Thus, the muskrat could obtain a large portion of its diet from the study area evaluated in this risk assessment. The muskrat was evaluated for exposure to chemicals through the ingestion of clams that may accumulate chemicals from sediments and water in the creek, as well as through the ingestion of water from the creek.

Avian Species

A list of avian species observed or expected at the Tennessee Products Site is provided in Table B-3. From this list, one specie was chosen for evaluation. The American robin (*Turdus migratorius*) was chosen as an indicator species for omnivorous songbirds in this assessment. The robin is expected to be one of the more maximally exposed bird species at the site because of the potential for exposure to chemicals through the ingestion of invertebrates, particularly earthworms, which make up a large percentage of its diet. In addition, the robin has a limited

Ecological Risk Assessment
Tennessee Products Site
Section: Section 3
Revision: 0
Date: April 1996

home range, from 0.11 to 0.75 acres (Young, 1951; Collins and Boyajian, 1965), and thus could be expected to obtain much of its dietary intake from the site. The robin is also a potential year-round resident at the site, and is representative of several predominantly ground-foraging omnivorous species potentially inhabiting the site. The robin was evaluated for exposure to chemicals in soils through the ingestion of soil invertebrates (*i.e.*, earthworms) that may accumulate chemicals from their environment, as well as through the incidental ingestion of soils while feeding.

3.1.3 Terrestrial Vegetation

A list of plant species observed at the site is presented in Table B-2. Chemicals in soil can enter a plant through four major pathways, including root uptake and translocation to aboveground plant parts; uptake from vapor; uptake from external contamination (dust and soil); and uptake and transport in oil cells (Bell, 1992). A direct comparison of soil concentrations with available phytotoxicity data was used to assess potential adverse effects on terrestrial vegetation.

3.1.4 Soil Invertebrates

Soil invertebrates, such as earthworms, are ecologically important because of their role in a number of processes including soil aeration, soil drainage, and soil fertility (EPA, 1992b). Soil invertebrates can be exposed to contaminants in the soil through dermal absorption and soil ingestion. Earthworm soil toxicity tests were conducted on soil samples collected at the site to assess the potential for adverse effects to occur to soil invertebrates.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 3
Revision: 0
Date: April 1996

3.1.5 Endangered and Threatened Species

The Tennessee Department of Environment and Conservation, the Tennessee Valley Authority, and the Georgia Department of Natural Resources were contacted for information regarding potential endangered and threatened species. The requested file search incorporated a 1-mile wide corridor on either side of Chattanooga Creek beginning at the Tennessee-Georgia state line and ending at the confluence with the Tennessee River. The review found records of a single federally listed plant species and 2 federal candidate species that have historically occurred in the vicinity of the site. These include the endangered large-flower skullcap (*Scutellaria montana*) and candidate spreading false-foxglove (*Aureolaria patula*) and goldenseal (*Hydrastis canadensis*). During WESTON's ecological site survey, no federal- or state-listed rare, threatened, or endangered species were encountered. Furthermore, based on the survey, it appears that little potential habitat remains to support such species.

3.1.6 Summary

A summary of all exposure routes for each of the selected indicator species or communities is presented in Table 3-1.

3.2 EXPOSURE CONCENTRATIONS

Areas of exposure are selected for the indicator species/communities based on the assessment of habitats and the known distribution of the chemicals at the site. The concentrations at these areas of exposure are important in determining exposure doses and subsequent risk to receptors.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 3
Revision: 0
Date: April 1996

Table 3-1

**Exposure Routes of Potential Concern to Ecological Receptors
Tennessee Products Site
Chattanooga, TN**

Habitat	Receptor	Exposure Route
Terrestrial		
Riparian Forest Community/ Clearcut Wetland	Short-tailed shrew	Ingestion of soil invertebrates (earthworms)
		Incidental ingestion of soil
	White-footed mouse	Ingestion of seeds
		Incidental ingestion of soil
	American robin	Ingestion of soil invertebrates (earthworms)
		Incidental ingestion of soil
	Terrestrial plants	Direct contact with and uptake from soil
	Soil invertebrates	Direct contact with and uptake from soil
Aquatic		
Stream (Chattanooga Creek)	Muskrat	Ingestion of clams
		Ingestion of surface water
	Aquatic life	Direct contact with surface water/sediments
		Ingestion of dietary items

Soils

There were 2 areas of soil contamination for which separate exposure concentrations were developed - the Tar Deposit Site and Hamill Road Dump No. 3. The soil exposure concentration used in assessing risk to birds and mammals was the 95 % upper confidence limit (UCL) of the mean, or the maximum detected concentration, whichever value was lower. The 95 % UCL of the mean was used to represent an upper-bound estimate of the average exposure concentration (EPA, 1992d). For stationary organisms (e.g. plants), the maximum concentration was evaluated as a potential exposure concentration.

The exposure concentrations were based on soils data collected from 0 to 0.5 feet and 0 to 2 feet. These soils were collected at the surface or near-surface, and represent the soil depths at which ecological receptors are most likely to be exposed. The 0 to 0.5 foot soil depth was used to estimate the soil ingestion route for all receptor organisms, except the shrew, which is a burrowing animal and will be exposed to soil from 0 to 2 feet. The 0 to 2 foot soil depth was used to estimate all other soil exposures (i.e., plant uptake, earthworm uptake)

Based on EPA Region 4 guidance, it was assumed that the soil data are lognormally distributed (EPA Reg 4, 1995b). The following equation was used to calculate the 95 % UCL of the mean for lognormally distributed data:

$$UCL = e^{(\bar{x} + 0.5s^2 + sH/\sqrt{n-1})}$$

Where:

UCL = 95 % upper confidence limit.

e = Constant (base of the natural log, equal to 2.718).

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 3
Revision: 0
Date: April 1996

x = Mean of the transformed data (log of the geometric mean).
s = Standard deviation of the transformed data.
H = H-statistic (Gilbert, 1987).
n = Number of samples.

In calculating the 95 % UCL of the mean, non-detects were incorporated as one-half the sample quantitation limit. Exposure point concentrations for soils are shown in Table 3-2 through 3-5.

Surface Water/Sediment

In the evaluation of surface water and sediment, each location was evaluated as a separate exposure point. This type of evaluation was made since the distance between sampling points ranged from a couple hundred feet to approximately ¼ mile, and since some aquatic organisms, such as benthic invertebrates, are relatively stationary and may be exposed to a localized area. The surface water and sediment data for each sampling location is presented in Appendix A.

Clam Tissue

Exposure to clams was evaluated for the muskrat, and the exposure point concentration used was the 95 % UCL of the mean, or the maximum detected concentration, whichever value was lower. The 95 % UCL of the mean was used to represent an upper-bound estimate of the average exposure concentration (EPA, 1992d). Since 3 clam sampling locations used in calculating the 95 % UCL were not a sufficiently robust data set, the UCL exceeded the maximum detected concentration for all chemicals. Thus, the exposure point concentration for clams is represented by the maximum detected concentration. The exposure point concentrations for clam tissue are presented in Table 3-6.

Table 3-2
Exposure Point Concentrations for Chemicals of Potential Concern
Detected in Tar Dump Soil (0 to 0.5 foot)
Tennessee Products Site, Chattanooga, TN

Chemical	Maximum Detected Concentration ^a (Organics - µg/kg) (Inorganics - mg/kg)	Upper 95% Confidence Limit (Organics - µg/kg) (Inorganics - mg/kg)	Exposure Point Concentration ^b
Organics			
Acetone	9.00E+04	1.66E+09	9.00E+04 *
alpha - BHC	8.50E+02	1.61E+03	8.50E+02 *
beta-BHC	4.50E+02	2.39E+03	4.50E+02 *
delta-BHC	2.60E+02	3.52E+03	2.60E+02 *
gamma-BHC	2.90E+02	2.85E+02	2.85E+02
Carbazole	2.70E+02	7.11E+02	2.70E+02 *
gamma-Chlordane	9.00E+01	7.01E+01	7.01E+01
Dieldrin	3.90E+03	1.40E+07	3.90E+03 *
Endosulfan I	1.00E+02	2.27E+02	1.00E+02 *
Endosulfan II	1.10E+02	2.25E+02	1.10E+02 *
Endrin aldehyde	8.70E+01	9.08E+01	8.70E+01 *
Heptachlor	3.00E+02	4.55E+04	3.00E+02 *
Heptachlor epoxide	8.80E+01	1.51E+02	8.80E+01 *
Hexachlorobenzene	5.80E+02	3.88E+02	3.88E+02
2-Methylnaphthalene	1.80E+02	8.55E+02	1.80E+02 *
Naphthalene	3.70E+02	7.66E+02	3.70E+02 *
PAHs			
Acenaphthylene	2.10E+03	2.34E+03	2.10E+03 *
Anthracene	1.70E+03	2.52E+03	1.70E+03 *
Benzo(a)anthracene	1.30E+04	1.16E+04	1.16E+04
Benzo(a)pyrene	1.50E+04	1.39E+04	1.39E+04
Benzo(b and/or k)fluoranthene	3.80E+04	3.12E+04	3.12E+04
Benzo(g,h,i)perylene	8.60E+03	6.41E+03	6.41E+03
Chrysene	1.30E+04	1.22E+04	1.22E+04
Dibenzo(a,h)anthracene	5.40E+03	6.42E+03	5.40E+03 *
Fluoranthene	1.30E+04	1.40E+04	1.30E+04 *
Indeno(1,2,3-cd)pyrene	1.20E+04	1.29E+04	1.20E+04 *
Phenanthrene	2.40E+03	4.31E+03	2.40E+03 *
Pyrene	1.40E+04	1.27E+04	1.27E+04
Tetrachloroethene	4.00E+00	6.44E+03	4.00E+00 *
1,1,1-Trichloroethane	3.00E+00	6.07E+03	3.00E+00 *
Trichloroethylene	2.00E+00	5.42E+03	2.00E+00 *
Inorganics			
Aluminum	1.40E+04	1.85E+04	1.40E+04 *
Arsenic	9.50E+00	8.58E+00	8.58E+00
Barium	1.40E+02	1.35E+02	1.35E+02
Chromium (total)	1.70E+02	2.12E+02	1.70E+02 *
Cobalt	1.80E+01	1.66E+01	1.66E+01
Copper	5.90E+01	3.11E+01	3.11E+01
Iron	2.10E+04	1.96E+04	1.96E+04
Lead	1.30E+02	1.74E+02	1.30E+02 *
Manganese	9.00E+02	8.29E+02	8.29E+02
Mercury	7.90E-01	1.25E+00	7.90E-01 *
Nickel	3.20E+01	2.68E+01	2.68E+01
Silver	2.70E+01	1.27E+01	1.27E+01
Vanadium	2.60E+01	2.41E+01	2.41E+01
Zinc	2.20E+02	2.08E+02	2.08E+02

a = Maximum detected concentration.

b = Upper 95% confidence limit (UCL) unless otherwise noted.

* = 95% UCL exceeds maximum detected concentration; exposure point concentration defaulted to the maximum detected concentration.

Table 3-3
Exposure Point Concentrations for Chemicals of Potential Concern
Detected in Tar Dump Soil (0 to 2 feet)
Tennessee Products Site, Chattanooga, TN

Chemical	Maximum Detected Concentration ^a (Organics - µg/kg) (Inorganics - mg/kg)	Upper 95% Confidence Limit (Organics - µg/kg) (Inorganics - mg/kg)	Exposure Point Concentration ^b
<i>Organics</i>			
Acetone	9.00E+04	4.63E+08	9.00E+04 *
Aldrin	2.80E+00	2.20E+01	2.80E+00 *
alpha - BHC	3.60E+03	1.22E+03	1.22E+03
beta-BHC	1.30E+03	1.22E+03	1.22E+03
delta-BHC	5.10E+02	1.06E+03	5.10E+02 *
gamma-BHC	1.10E+03	4.27E+02	4.27E+02
Carbazole	4.40E+02	4.94E+02	4.40E+02 *
alpha-Chlordane	3.60E+01	1.44E+02	3.60E+01 *
gamma-Chlordane	9.00E+01	3.12E+01	3.12E+01
DDD	3.00E+01	2.57E+01	2.57E+01
DDT	7.80E+00	4.58E+01	7.80E+00 *
Dibenzofuran	1.00E+02	8.52E+02	1.00E+02 *
Dieldrin	3.90E+03	3.85E+04	3.90E+03 *
Endosulfan I	1.00E+02	1.29E+02	1.00E+02 *
Endosulfan II	1.20E+02	7.07E+01	7.07E+01
Endrin	7.00E+01	3.78E+01	3.78E+01
Endrin aldehyde	8.70E+01	4.41E+01	4.41E+01
Heptachlor	3.00E+02	1.07E+03	3.00E+02 *
Heptachlor epoxide	1.60E+02	7.36E+01	7.36E+01
Hexachlorobenzene	5.80E+02	6.54E+02	5.80E+02 *
Methoxychlor	9.90E+01	1.85E+02	9.90E+01 *
2-Methylnaphthalene	1.80E+02	7.35E+02	1.80E+02 *
Naphthalene	4.60E+02	5.56E+02	4.60E+02 *
<i>PAHs</i>			
Acenaphthylene	4.50E+03	1.68E+03	1.68E+03
Anthracene	3.50E+03	1.36E+03	1.36E+03
Benzo(a)anthracene	3.80E+04	1.54E+04	1.54E+04
Benzo(a)pyrene	5.00E+04	2.23E+04	2.23E+04
Benzo(b and/or k)fluoranthene	9.80E+04	3.53E+04	3.53E+04
Benzo(g,h,i)perylene	2.20E+04	8.86E+03	8.86E+03
Chrysene	4.00E+04	1.59E+04	1.59E+04
Dibenzo(a,h)anthracene	1.20E+04	6.39E+03	6.39E+03
Fluoranthene	4.60E+04	2.05E+04	2.05E+04
Indeno(1,2,3-cd)pyrene	2.70E+04	1.23E+04	1.23E+04
Phenanthrene	7.40E+03	3.90E+03	3.90E+03
Pyrene	4.20E+04	1.62E+04	1.62E+04
Tetrachloroethene	4.00E+00	8.24E+03	4.00E+00 *
1,1,1-Trichloroethane	8.00E+00	6.98E+03	8.00E+00 *
Trichloroethylene	3.00E+00	6.88E+03	3.00E+00 *
Xylenes (total)	1.00E+00	7.40E+03	1.00E+00 *
<i>Inorganics</i>			
Aluminum	1.40E+04	1.14E+04	1.14E+04
Arsenic	1.40E+01	9.52E+00	9.52E+00
Barium	1.50E+02	1.17E+02	1.17E+02
Beryllium	1.40E+00	9.70E-01	9.70E-01
Cadmium	3.70E-01	4.00E-01	3.70E-01 *
Chromium (total)	3.60E+02	1.83E+02	1.83E+02
Cobalt	2.40E+01	2.01E+01	2.01E+01
Copper	5.90E+01	2.87E+01	2.87E+01
Iron	2.10E+04	1.87E+04	1.87E+04
Lead	1.30E+02	8.27E+01	8.27E+01
Manganese	1.20E+03	8.13E+02	8.13E+02
Mercury	7.90E-01	1.16E+00	7.90E-01 *
Nickel	4.10E+01	3.20E+01	3.20E+01
Selenium	1.60E+00	7.30E-01	7.30E-01
Silver	2.70E+01	4.05E+00	4.05E+00
Vanadium	2.60E+01	2.20E+01	2.20E+01
Zinc	2.20E+02	1.76E+02	1.76E+02
Cyanide	7.80E-01	3.60E-01	3.60E-01

a = Maximum detected concentration.

b = Upper 95% confidence limit (UCL) unless otherwise noted.

* = 95% UCL exceeds maximum detected concentration; exposure point concentration defaulted to the maximum detected concentration.

Table 3-4
Exposure Point Concentrations for Chemicals of Potential Concern
Detected in Hamill Road Dump #3 Soil (0 to 0.5 foot)
Tennessee Products Site, Chattanooga, TN

Chemical	Maximum Detected Concentration ^a (Organics - µg/kg) (Inorganics - mg/kg)	Upper 95% Confidence Limit (Organics - µg/kg) (Inorganics - mg/kg)	Exposure Point Concentration ^b
Organics			
Aldrin	1.30E+00	3.00E+01	1.30E+00 *
beta-BHC	3.80E+02	2.10E+05	3.80E+02 *
delta-BHC	9.30E+01	9.18E+03	9.30E+01 *
gamma-BHC	1.10E+02	1.40E+09	1.10E+02 *
Carbazole	1.30E+02	9.75E+06	1.30E+02 *
DDT	4.40E+01	5.17E+02	4.40E+01 *
Dibenzofuran	5.60E+01	1.76E+06	5.60E+01 *
Dieldrin	3.40E+02	6.41E+03	3.40E+02 *
Endosulfan I	2.00E+02	2.85E+03	2.00E+02 *
Endosulfan II	5.40E+01	3.75E+02	5.40E+01 *
Endosulfan sulfate	3.10E+01	1.84E+02	3.10E+01 *
Endrin	3.20E+01	3.21E+02	3.20E+01 *
Heptachlor	9.20E+01	7.51E+02	9.20E+01 *
Hexachlorobenzene	3.00E+02	8.84E+01	8.84E+01 *
2-Methylnaphthalene	8.20E+01	1.24E+06	8.20E+01 *
Naphthalene	1.80E+02	5.85E+06	1.80E+02 *
PAHs			
Acenaphthylene	3.40E+02	1.64E+06	3.40E+02 *
Anthracene	2.50E+03	1.62E+04	2.50E+03 *
Benzo(a)anthracene	2.00E+04	1.10E+05	2.00E+04 *
Benzo(a)pyrene	1.90E+04	9.75E+04	1.90E+04 *
Benzo(b and/or k)fluoranthene	4.50E+04	2.24E+05	4.50E+04 *
Benzo(g,h,i)perylene	1.10E+03	7.24E+04	1.10E+03 *
Chrysene	2.30E+04	1.21E+05	2.30E+04 *
Dibenzo(a,h)anthracene	5.00E+03	2.23E+04	5.00E+03 *
Fluoranthene	3.90E+04	2.94E+05	3.90E+04 *
Indeno(1,2,3-cd)pyrene	1.30E+04	5.99E+04	1.30E+04 *
Phenanthrene	5.70E+03	1.41E+04	5.70E+03 *
Pyrene	3.70E+04	2.40E+05	3.70E+04 *
Styrene	2.00E+00	1.16E+01	2.00E+00 *
1,1,1-Trichloroethane	3.50E+01	3.50E+01	3.50E+01
Inorganics			
Aluminum	1.30E+04	1.29E+04	1.29E+04
Arsenic	1.10E+01	1.14E+01	1.10E+01 *
Barium	1.30E+02	1.23E+02	1.23E+02
Chromium (total)	8.60E+01	8.01E+01	8.01E+01
Cobalt	1.80E+01	1.70E+01	1.70E+01
Copper	5.40E+01	5.36E+01	5.36E+01
Iron	2.10E+04	2.13E+04	2.10E+04 *
Lead	7.40E+01	7.42E+01	7.40E+01 *
Manganese	1.30E+03	1.35E+03	1.30E+03 *
Mercury	3.30E-01	5.50E-01	3.30E-01 *
Nickel	2.70E+01	2.54E+01	2.54E+01
Selenium	2.10E+00	2.35E+00	2.10E+00 *
Vanadium	2.50E+01	2.53E+01	2.50E+01 *
Zinc	1.40E+02	1.41E+02	1.40E+02 *
Cyanide	1.50E+00	1.28E+00	1.28E+00

a = Maximum detected concentration.

b = Upper 95% confidence limit (UCL) unless otherwise noted.

* = 95% UCL exceeds maximum detected concentration; exposure point concentration defaulted to the maximum detected concentration.

Table 3-5
Exposure Point Concentrations for Chemicals of Potential Concern
Detected in Hamill Road Dump #3 Soil (0 to 2 feet)
Tennessee Products Site, Chattanooga, TN

Chemical	Maximum Detected Concentration ^a (Organics - µg/kg) (Inorganics - mg/kg)	Upper 95% Confidence Limit (Organics - µg/kg) (Inorganics - mg/kg)	Exposure Point Concentration ^b
<i>Organics</i>			
Aldrin	1.30E+00	1.53E+01	1.30E+00 *
beta-BHC	3.80E+02	7.57E+04	3.80E+02 *
delta-BHC	9.30E+01	1.91E+03	9.30E+01 *
gamma-BHC	1.10E+02	1.22E+03	1.10E+02 *
Carbazole	5.50E+02	2.33E+04	5.50E+02 *
alpha-Chlordane	1.90E+00	3.35E+03	1.90E+00 *
DDT	4.40E+01	9.42E+01	4.40E+01 *
Dibenzofuran	1.80E+02	2.10E+04	1.80E+02 *
Dieldrin	3.40E+02	2.21E+03	3.40E+02 *
Endosulfan I	2.00E+02	2.77E+02	2.00E+02 *
Endosulfan II	5.40E+01	1.20E+02	5.40E+01 *
Endosulfan sulfate	3.10E+01	5.66E+01	3.10E+01 *
Endrin	3.20E+01	5.10E+01	3.20E+01 *
Heptachlor	9.20E+01	1.23E+02	9.20E+01 *
Hexachlorobenzene	3.00E+02	2.82E+01	2.82E+01
2-Methylnaphthalene	8.20E+01	2.18E+04	8.20E+01 *
Naphthalene	3.40E+02	2.30E+04	3.40E+02 *
<i>PAHs</i>			
Acenaphthylene	1.60E+03	2.59E+04	1.60E+03 *
Anthracene	2.50E+03	1.58E+03	1.58E+03
Benzo(a)anthracene	2.00E+04	4.92E+04	2.00E+04 *
Benzo(a)pyrene	1.90E+04	5.30E+04	1.90E+04 *
Benzo(b and/or k)fluoranthene	4.50E+04	1.25E+05	4.50E+04 *
Benzo(g,h,i)perylene	4.00E+03	2.78E+04	4.00E+03 *
Chrysene	2.30E+04	5.62E+04	2.30E+04 *
Dibenzo(a,h)anthracene	5.00E+03	5.53E+03	5.00E+03 *
Fluoranthene	3.90E+04	1.21E+05	3.90E+04 *
Indeno(1,2,3-cd)pyrene	1.30E+04	3.24E+04	1.30E+04 *
Phenanthrene	5.70E+03	6.50E+03	5.70E+03 *
Pyrene	3.70E+04	9.51E+04	3.70E+04 *
Styrene	7.00E+00	6.84E+00	6.84E+00
1,1,1-Trichloroethane	3.50E+01	1.90E+01	1.90E+01
Xylenes (total)	3.00E+00	6.83E+00	3.00E+00 *
<i>Inorganics</i>			
Aluminum	1.60E+04	1.53E+04	1.53E+04
Arsenic	1.20E+01	1.01E+01	1.01E+01
Barium	1.30E+02	1.25E+02	1.25E+02
Beryllium	1.50E+00	9.90E-01	9.90E-01
Chromium (total)	8.60E+01	4.78E+01	4.78E+01
Cobalt	1.80E+01	1.90E+01	1.80E+01 *
Copper	5.40E+01	2.86E+01	2.86E+01
Iron	2.10E+04	2.14E+04	2.10E+04 *
Lead	7.40E+01	4.68E+01	4.68E+01
Manganese	2.00E+03	2.08E+03	2.00E+03 *
Mercury	4.20E-01	2.20E-01	2.20E-01
Nickel	2.70E+01	2.40E+01	2.40E+01
Selenium	2.30E+00	2.09E+00	2.09E+00
Vanadium	2.60E+01	2.77E+01	2.60E+01 *
Zinc	1.40E+02	9.35E+01	9.35E+01
Cyanide	1.50E+00	6.40E-01	6.40E-01

a = Maximum detected concentration.

b = Upper 95% confidence limit (UCL) unless otherwise noted.

* = 95% UCL exceeds maximum detected concentration; exposure point concentration defaulted to the maximum detected concentration.

Table 3-6
Exposure Point Concentrations for Chemicals of Potential Concern
Detected in Chattanooga Creek Surface Water
Tennessee Products Site, Chattanooga, TN

Chemical	Maximum Detected Concentration ^a (Organics - µg/L) (Inorganics - mg/L)	Upper 95% Confidence Limit (Organics - µg/L) (Inorganics - mg/L)	Exposure Point Concentration ^b
<i>Organics</i>			
Bis(2-ethylhexyl)phthalate	1.30E+01	8.56E+00	8.56E+00
<i>Inorganics</i>			
Aluminum	4.90E-01	3.90E-01	3.90E-01
Barium	4.20E-02	3.00E-02	3.00E-02
Copper	4.10E-03	NC	4.10E-03
Iron	1.60E+00	9.90E-01	9.90E-01
Manganese	4.50E-01	2.70E-01	2.70E-01
Strontium	8.60E-02	8.00E-02	8.00E-02
Titanium	9.90E-03	1.00E-02	9.90E-03 *
Zinc	1.80E-02	1.00E-02	1.00E-02

a = Maximum detected concentration.

b = Upper 95% confidence limit (UCL) unless otherwise noted.

NC = Not calculated; insufficient sample size to calculate 95% UCL.

* = 95% UCL exceeds maximum detected concentration; exposure point concentration defaulted to the maximum detected concentraion.

Earthworm/Tissue/Plant Tissue

Earthworm and plant tissue were not collected for chemical analysis at the site. Exposure point concentrations were modeled for earthworms and plants, as described in Appendix C and D, respectively. These exposure point concentrations were modeled from the soil exposure point concentrations.

3.3 ESTIMATION OF EXPOSURE DOSES

This subsection discusses the methods by which chemical intakes are estimated for the selected indicator species. The models used to estimate exposure doses in milligrams of contaminant intake per kilogram of body weight per day (mg/kg-day) for the Northern short-tailed shrew, white-footed mouse, muskrat, and American robin are presented here.

3.3.1 Northern Short-Tailed Shrew

Primary routes of potential exposure to the short-tailed shrew include the ingestion of soil invertebrates and the incidental ingestion of surface soil. The methodology used to calculate the exposure for the shrew and the associated assumptions are presented in the following paragraphs.

Ingestion of Soil Invertebrates

Diets are variable among species of shrew, but in general, they are composed of earthworms, insects, and other invertebrates (DeGraaf and Rudis, 1986). The composition and quantity of the diet of the shrew can also vary with season and availability of resources as well as health,

Ecological Risk Assessment
Tennessee Products Site
Section: Section 3
Revision: 0
Date: April 1996

age, and sex of the species. For this assessment potential exposure to the short-tailed shrew from chemicals of concern in its daily diet was evaluated for the consumption of earthworms. Although the diet of the shrew does not consist entirely of earthworms, the earthworm was used to represent a typical soil invertebrate potentially ingested by the shrew since (1) the earthworm is one of the few invertebrates for which chemical uptake can be estimated, and (2) earthworms would be expected to significantly bioaccumulate chemicals found in the soil as a result of both dermal absorption and soil ingestion.

The exposure doses to the short-tailed shrew through ingestion of earthworms were determined using the approach and assumptions presented in Table 3-7. The estimation of chemical concentrations in earthworms is discussed in Appendix C. The daily earthworm ingestion rate for the short-tailed shrew was assumed to be 0.62 g wet weight/g body weight per day based on information for male and female adult short-tailed shrews which were fed a diet of beef liver (EPA, 1993a). Assuming a mean body weight of 15 grams for an adult short-tailed shrew (EPA, 1993a), a wet weight ingestion rate of 9.3 grams was estimated. A dry weight dietary intake of 2.8 g/day was estimated from the wet weight ingestion rate of 9.3 g/day, based on a water content of 69.7% in the study diet (*i.e.*, beef liver) (Baes et al., 1984). The wet weight ingestion rate of 9.3 g/day or 0.62 g/g body weight per day is similar to ingestion rates reported for the short-tailed shrew in other sources (Opresko et al., 1994; Churchfield, 1990).

The home range of the short-tailed shrew ranges from 0.5 to 1 acre (Burt and Grossenheider, 1980; Merritt, 1987). The sampling area of the Tar Dump Site covers approximately 0.25 to 0.5 acres, and the area between the sampling transects at the Hamill Road Dump No. 3 covers approximately 1 acre. Since the home range of the shrew either falls within or is close to the area of the dumps, it was assumed that 100% of the shrew's forage would be obtained from within the boundaries of each area.

Table 3-7
Exposure Point Concentrations for Chemicals Detected in Clam Tissue
Tennessee Products Site, Chattanooga, TN

Chemical	Maximum Detected Concentration ^a (Organics - µg/kg) (Inorganics - mg/kg)	Upper 95% Confidence Limit (Organics - µg/kg) (Inorganics - mg/kg)	Exposure Point Concentration ^b
<i>Organics</i>			
<i>PAHs</i>			
Benzo(a)anthracene	1.80E-01	1.29E+03	1.80E-01 *
Chrysene	1.80E-01	1.29E+03	1.80E-01 *
Fluoranthene	3.00E-01	3.85E+01	3.00E-01 *
<i>Inorganics</i>			
Aluminum	1.80E+02	1.88E+02	1.80E+02 *
Arsenic	1.50E+00	2.28E+01	1.50E+00 *
Barium	2.40E+00	2.50E+00	2.40E+00 *
Cobalt	3.50E-01	4.10E-01	3.50E-01 *
Copper	1.40E+01	1.84E+01	1.40E+01 *
Iron	3.00E+02	3.22E+02	3.00E+02 *
Manganese	2.50E+01	2.65E+01	2.50E+01 *
Mercury	2.40E-02	3.00E-02	2.40E-02 *
Nickel	7.60E-01	7.90E-01	7.60E-01 *
Selenium	1.30E+00	2.33E+00	1.30E+00 *
Strontium	1.20E+00	1.36E+00	1.20E+00 *
Titanium	1.20E+00	1.32E+00	1.20E+00 *
Vanadium	2.50E-01	3.10E-01	2.50E-01 *
Zinc	3.50E+01	4.54E+01	3.50E+01 *

a = Maximum detected concentration.

b = Upper 95% confidence limit (UCL) unless otherwise noted.

* = 95% UCL exceeds maximum detected concentration; exposure point concentration defaulted to the maximum detected concentration.

Incidental Ingestion of Soil

The short-tailed shrew may also be exposed to chemicals through the incidental ingestion of surface soil. Mammals with feeding and burrowing habits, such as the shrew can inadvertently ingest surface soil while consuming soil invertebrates or while preening or burrowing. The model and assumptions used to estimate exposure doses to the short-tailed shrew through soil ingestion is presented in Table 3-7.

Data regarding the incidental soil ingestion rate of the short-tailed shrew were not available. EPA (1993a) reports that the percent soil in the diet of a woodcock, which feeds extensively on earthworms, is approximately 10.4%. EPA (1993a) further suggests that other species that ingest earthworms might be expected to have similar soil intakes. A best estimate of 10.4% of the dry weight dietary ingestion rate was used for the short-tailed shrew's incidental soil ingestion rate. A dry weight soil ingestion rate of 0.29 g/day was calculated for the shrew based on 10.4% of its dry weight dietary intake of 2.8 g/day.

Total Exposure to the Northern Short-tailed Shrew

Based on the previous discussion, the total exposure of the shrew to chemicals from the site was derived as follows:

$$\text{Dose}_{\text{Total}} = \text{Dose}_{\text{worm}} + \text{Dose}_{\text{soil}}$$

Where:

$\text{Dose}_{\text{Total}}$	=	Total dose (mg/kg-day).
$\text{Dose}_{\text{worm}}$	=	Dose from ingestion of earthworms (mg/kg-day).
$\text{Dose}_{\text{soil}}$	=	Dose from soil ingestion (mg/kg-day).

The total and route-specific exposure doses estimated for the shrew are presented in Tables 3-8 and 3-9 for the Tar Dump and Hamill Road Dump No. 3, respectively.

3.3.2 White-Footed Mouse

Primary routes of potential on-site exposure for the white-footed mouse include the ingestion of plant material (i.e., seeds) and incidental ingestion of soil. The methodology used to calculate the various exposures to the mouse and the associated assumptions are presented in the following paragraphs.

Ingestion of Plant Seeds

The diet of the white-footed mouse consists mainly of seeds, nuts, and insects (Burt and Grossenheider, 1976). The composition and quantity of a white-footed mouse's diet can vary with season and availability of resources as well as health, age, and sex of the species (Chapman and Feldhamer, 1982). However, for this assessment, potential exposure to the white-footed mouse from chemicals of potential concern in its daily diet was only evaluated for the consumption of plant seeds. Sufficient information does not exist with which to estimate chemical uptake in other dietary items.

The exposure doses to the white-footed mouse through ingestion of seeds were determined using the approach and assumptions as presented in Table 3-10. The ingestion rate for white-footed mice was assumed to be 0.2 g wet weight/g body weight per day, which is the midpoint of the reported range (0.18 - 0.22 g/g-day) for nonbreeding adult deer mice (*Peromyscus maniculatus*) (EPA, 1993a). The white-footed mouse and deer mouse are morphologically, behaviorally, and ecologically similar (Wolff, 1985), and thus it was assumed that their ingestion rates would also

Table 3-8

**Model for Estimating Daily Intake by a Short-tailed Shrew
Tennessee Products Site, Chattanooga, TN**

$$EDI_{total} = EDI_{soil} + EDI_{soil\ invertebrates}$$

and

$$EDI_{soil} = \frac{CS \times SIR \times FI}{BW \times CF}$$

$$EDI_{soil\ invertebrates} = \frac{CI \times IIR \times FI}{BW \times CF}$$

where:

EDI_{total}	=	Total estimated daily intake (mg/kg-day).
EDI_{soil}	=	Estimated daily intake through soil ingestion (mg/kg-day).
$EDI_{soil\ invertebrates}$	=	Estimated daily intake through soil invertebrate ingestion (mg/kg-day).
CS	=	Chemical concentration in soil (mg/kg).
CI	=	Chemical concentration in invertebrate (mg/kg)
SIR	=	Soil ingestion rate - 0.29 g dry weight/day; assumed to be 10.4% of food intake based on the woodcock, another species that feeds extensively on earthworms (EPA, 1993a).
IIR	=	Invertebrate ingestion rate - 2.8 g dry weight/day; converted from a wet ingestion rate of 0.62 g/g body weight/day (EPA, 1993a) assuming a water content of 69.7% in study diet (i.e., beef liver) (Baes et al., 1984).
FI	=	Fraction ingested from contaminated source - 1; the home range of the short-tailed shrew, 0.5 to 1.5 acres (Burt and Grossenheider, 1980; Merritt, 1987), falls within the area of the site.
BW	=	Body weight - 0.015 kg (EPA, 1993a).
CF	=	Conversion factor - 1,000 g/kg.

Table 3-9
Estimated Daily Intake of Chemicals of Potential Concern
Northern Short-tailed Shrew
Tar Dump
Tennessee Products Site, Chattanooga, TN

Chemical	Estimated Daily Intake	
	Soil Ingestion Pathway • (mg/kg-day)	Earthworm Ingestion Pathway • (mg/kg-day)
Organics		
Acetone	1.74E+00	NC
Aldrin	5.41E-05	1.72E-03
alpha - BHC	2.37E-02	2.31E+00
beta-BHC	2.36E-02	2.30E+00
delta-BHC	9.86E-03	9.62E-01
gamma-BHC	8.25E-03	8.05E-01
Carbazole	8.51E-03	NC
alpha-Chlordane	6.96E-04	3.36E-02
gamma-Chlordane	6.03E-04	2.91E-02
DDD	4.96E-04	3.97E-02
DDT	1.51E-04	1.54E-02
Dibenzofuran	1.93E-03	NC
Dieldrin	7.54E-02	7.21E+00
Endosulfan I	1.93E-03	NC
Endosulfan II	1.37E-03	NC
Endrin	7.31E-04	2.54E-02
Endrin aldehyde	8.53E-04	NC
Heptachlor	5.80E-03	NC
Heptachlor epoxide	1.42E-03	4.12E-02
Hexachlorobenzene	1.12E-02	NC
Methoxychlor	1.91E-03	5.17E-01
2-Methylnaphthalene	3.48E-03	NC
Naphthalene	8.89E-03	1.80E-02
PAHs		
Acenaphthylene	3.24E-02	6.88E-02
Anthracene	2.63E-02	8.13E-02
Benzo(a)anthracene	2.97E-01	7.75E-01
Benzo(a)pyrene	4.32E-01	1.42E+00
Benzo(b and/or k)fluoranthene	6.82E-01	1.38E+00
Benzo(g,h,i)perylene	1.71E-01	2.48E-01
Chrysene	3.07E-01	1.30E+00
Dibenzo(a,h)anthracene	1.24E-01	5.85E-01
Fluoranthene	3.96E-01	1.41E+00
Indeno(1,2,3-cd)pyrene	2.38E-01	9.40E-01
Phenanthrene	7.54E-02	2.04E-01
Pyrene	3.14E-01	1.18E+00
Tetrachloroethene	7.73E-05	NC
1,1,1-Trichloroethane	1.55E-04	NC
Trichloroethylene	5.80E-05	NC
Xylenes (total)	1.93E-05	NC
Inorganics		
Aluminum	2.20E+02	7.23E+02
Arsenic	1.84E-01	8.53E-02
Barium	2.25E+00	7.84E+00
Beryllium	1.88E-02	NC
Cadmium	7.15E-03	3.18E-01
Chromium (total)	3.54E+00	2.63E+01
Cobalt	3.88E-01	NC
Copper	5.55E-01	2.36E+00
Iron	3.61E+02	1.32E+03
Lead	1.60E+00	8.19E+00
Manganese	1.57E+01	1.67E+01
Mercury	1.53E-02	5.38E-02
Nickel	6.18E-01	1.07E+01
Selenium	1.41E-02	NC
Silver	7.83E-02	NC
Vanadium	4.26E-01	NC
Zinc	3.40E+00	3.25E+02
Cyanide	6.96E-03	NC

NC = Not calculated due to the lack of appropriate accumulation data.
 • Maximum soil exposure concentrations from 0 to 2 feet deep.

Table 3-10
Estimated Daily Intake of Chemicals of Potential Concern
Northern Short-tailed Shrew
Hamill Road Dump #3
Tennessee Products Site, Chattanooga, TN

Chemical	Estimated Daily Intake	
	Soil Ingestion Pathway • (mg/kg-day)	Earthworm Ingestion Pathway • (mg/kg-day)
Organics		
Aldrin	2.51E-05	8.01E-04
beta-BHC	7.35E-03	7.16E-01
delta-BHC	1.80E-03	1.75E-01
gamma-BHC	2.13E-03	2.07E-01
Carbazole	1.06E-02	NC
alpha-Chlordane	3.67E-05	1.77E-03
DDT	8.51E-04	8.71E-02
Dibenzofuran	3.48E-03	NC
Dieldrin	6.57E-03	6.28E-01
Endosulfan I	3.87E-03	NC
Endosulfan II	1.04E-03	NC
Endosulfan sulfate	5.99E-04	NC
Endrin	6.19E-04	2.15E-02
Heptachlor	1.78E-03	NC
Hexachlorobenzene	5.44E-04	NC
2-Methylnaphthalene	1.59E-03	NC
Naphthalene	6.57E-03	1.33E-02
PAHs		
Acenaphthylene	3.09E-02	6.57E-02
Anthracene	3.06E-02	9.46E-02
Benzo(a)anthracene	3.87E-01	1.01E+00
Benzo(a)pyrene	3.67E-01	1.21E+00
Benzo(b and/or k)fluoranthene	8.70E-01	1.76E+00
Benzo(g,h,i)perylene	7.73E-02	1.12E-01
Chrysene	4.45E-01	1.89E+00
Dibenzo(a,h)anthracene	9.67E-02	4.57E-01
Fluoranthene	7.54E-01	2.69E+00
Indeno(1,2,3-cd)pyrene	2.51E-01	9.95E-01
Phenanthrene	1.10E-01	2.98E-01
Pyrene	7.15E-01	2.69E+00
Styrene	1.32E-04	NC
1,1,1-Trichloroethane	3.68E-04	NC
Xylenes (total)	5.80E-05	NC
Inorganics		
Aluminum	2.96E+02	9.70E+02
Arsenic	1.95E-01	9.05E-02
Barium	2.41E+00	8.39E+00
Beryllium	1.91E-02	NC
Chromium (total)	9.25E-01	6.88E+00
Cobalt	3.48E-01	NC
Copper	5.54E-01	2.35E+00
Iron	4.06E+02	1.49E+03
Lead	9.05E-01	4.63E+00
Manganese	3.87E+01	4.11E+01
Mercury	4.25E-03	1.50E-02
Nickel	4.65E-01	8.07E+00
Selenium	4.04E-02	NC
Vanadium	5.03E-01	NC
Zinc	1.81E+00	1.73E+02
Cyanide	1.24E-02	NC

NC = Not calculated due to the lack of appropriate accumulation data.

• Maximum soil exposure concentrations from 0 to 2 feet deep.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 3
Revision: 0
Date: April 1996

be similar. The midpoint of the body weights reported for adult white-footed mice was 20 g (based on a range of 13 to 27 g) (Merritt, 1987). Thus, a daily wet weight ingestion rate of 4 g/day was estimated. A dry weight dietary intake of 3.9 g/day was estimated from the wet weight ingestion rate, based on a water content of 3% in the laboratory rat chow diet (EPA, 1993a). The estimation of chemical concentrations in plant seeds is discussed further in Appendix D.

The mouse's home range is reported to range from 0.1 to 2.5 acres (Burt and Grossenheider, 1980; Merritt, 1987). The sampling area of the Tar Dump Site covers approximately 0.25 to 0.5 acres, and the area between the sampling transects at the Hamill Road Dump No. 3 covers approximately 1 acre. Since the lower end of the home range for the mouse falls within the area of the dumps, it was assumed that 100% of the mouse's forage would be obtained from within the boundaries of each area.

Incidental Ingestion of Soil

The white-footed mouse may also be exposed to chemicals through the incidental ingestion of surface soil. Mammals with ground foraging and nesting habits such as the white-footed mouse tend to have increased exposure to surface soils. Therefore, it was assumed that the mouse may inadvertently ingest surface soil while consuming plant seeds or while preening, nesting, or foraging. The exposure doses to the white-footed mouse through incidental ingestion of soil were determined using the approach and assumptions as presented in Table 3-10.

It has been estimated that less than 2% of the dry weight dietary intake of the white-footed mouse consists of soil (EPA, 1993a). For this assessment it was assumed that soil intake is 2%

of the dietary intake. A dry weight soil ingestion rate of 0.078 g/day was calculated for the white-footed mouse based on 2% of its dry weight dietary intake of 3.9 g/day.

Total Exposure to the White-Footed Mouse

Based on the previous discussion, the total exposure of the white-footed mouse to chemicals from the site was derived as follows:

$$\text{Dose}_{\text{Total}} = \text{Dose}_{\text{plant}} + \text{Dose}_{\text{soil}}$$

Where:

$\text{Dose}_{\text{Total}}$	=	Total dose (mg/kg-day).
$\text{Dose}_{\text{plant}}$	=	Dose from ingestion of plant seeds (mg/kg-day).
$\text{Dose}_{\text{soil}}$	=	Dose from soil ingestion (mg/kg-day).

The total and route-specific exposure doses estimated for the white-footed mouse are presented in Tables 3-11 and 3-12 for the Tar Dump and Hamill Road Dump No. 3, respectively.

3.3.3 American Robin

The primary routes of potential on-site exposure that were evaluated for the American robin include the ingestion of soil invertebrates and the incidental ingestion of soil. The methodology used to calculate the exposure doses for the robin and the associated assumptions are presented in the following paragraphs.

Table 3-11

**Model for Estimating Daily Intake by a White-Footed Mouse
Tennessee Products Site, Chattanooga, TN**

$$EDI_{total} = EDI_{soil} + EDI_{seed}$$

and

$$EDI_{soil} = \frac{CS \times SIR \times FI}{BW \times CF}$$

$$EDI_{seeds} = \frac{CP \times PIR \times FI}{BW \times CF}$$

where:

EDI_{total}	=	Total estimated daily intake (mg/kg-day).
EDI_{soil}	=	Estimated daily intake through soil ingestion (mg/kg-day).
EDI_{seed}	=	Estimated daily intake through seed ingestion (mg/kg-day).
CS	=	Chemical concentration in soil (mg/kg).
CP	=	Chemical concentration in plant seeds (mg/kg dry weight) - equals soil concentration (CS) x chemical-specific plant uptake factor (PUF).
SIR	=	Soil ingestion rate - 0.078 g dry weight/day; assumed to be 2% of total food intake (EPA, 1993a).
PIR	=	Plant ingestion rate - 3.9 g dry weight/day; based on deer mouse (EPA, 1993a).
FI	=	Fraction ingested from contaminated source - 1; the home range of the white-footed mouse, 0.5 to 2.5 acres (Burt and Grossenheider, 1976; Merritt, 1987), falls within the areas of contamination on the site.
BW	=	Body weight - 0.020 kg (Merritt, 1987).
CF	=	Conversion factor - 1,000 g/kg.

Table 3-12
Estimated Daily Intake of Chemicals of Potential Concern
White-footed Mouse
Tar Dump
Tennessee Products Site, Chattanooga, TN

Chemical	Estimated Daily Intake	
	Soil Ingestion Pathway ^a (mg/kg-day)	Seed Ingestion Pathway ^b (mg/kg-day)
Organics		
Acetone	3.51E-01	9.35E+02
Aldrin	ND	3.85E-04
alpha - BHC	3.32E-03	5.15E-02
beta-BHC	1.76E-03	5.12E-02
delta-BHC	1.01E-03	1.64E-02
gamma-BHC	1.11E-03	1.79E-02
Carbazole	1.05E-03	4.17E-02
alpha-Chlordane	ND	6.72E-03
gamma-Chlordane	2.74E-04	5.83E-03
DDD	ND	6.68E-05
DDT	ND	8.78E-05
Dibenzofuran	ND	2.94E-03
Dieldrin	1.52E-02	2.65E-01
Endosulfan I	3.90E-04	6.70E-03
Endosulfan II	4.29E-04	4.32E-03
Endrin	ND	1.66E-04
Endrin aldehyde	3.39E-04	1.93E-04
Heptachlor	1.17E-03	6.49E-03
Heptachlor epoxide	3.43E-04	1.53E-02
Hexachlorobenzene	1.51E-03	2.90E-03
Methoxychlor	ND	2.44E-03
2-Methylnaphthalene	7.02E-04	5.72E-03
Naphthalene	1.44E-03	3.97E-02
PAHs		
Acenaphthylene	8.19E-03	8.96E-02
Anthracene	6.63E-03	2.44E-02
Benzo(a)anthracene	4.54E-02	6.65E-02
Benzo(a)pyrene	5.41E-02	4.12E-02
Benzo(b and/or k)fluoranthene	1.22E-01	8.37E-02
Benzo(g,h,i)perylene	2.50E-02	1.16E-02
Chrysene	4.75E-02	6.86E-02
Dibenzo(a,h)anthracene	2.11E-02	2.80E-02
Fluoranthene	5.07E-02	1.53E-01
Indeno(1,2,3-cd)pyrene	4.68E-02	1.60E-02
Phenanthrene	9.36E-03	7.19E-02
Pyrene	4.97E-02	1.24E-01
Tetrachloroethene	1.56E-05	1.04E-03
1,1,1-Trichloroethane	1.17E-05	2.26E-03
Trichloroethylene	7.80E-06	9.04E-04
Xylenes (total)	ND	1.07E-04
Inorganics		
Aluminum	5.46E+01	1.44E+00
Arsenic	3.35E-02	1.11E-02
Barium	5.26E-01	3.41E-01
Beryllium	ND	2.84E-04
Cadmium	ND	1.08E-02
Chromium (total)	6.63E-01	1.61E-01
Cobalt	6.47E-02	2.74E-02
Copper	1.21E-01	1.40E+00
Iron	7.66E+01	3.64E+00
Lead	5.07E-01	1.45E-01
Manganese	3.23E+00	7.93E+00
Mercury	3.08E-03	3.08E-02
Nickel	1.04E-01	3.74E-01
Selenium	ND	3.56E-03
Silver	4.94E-02	7.90E-02
Vanadium	9.41E-02	1.29E-02
Zinc	8.10E-01	3.08E+01
Cyanide	ND	9.48E-02

ND = Not detected in associated medium.

^a Maximum soil exposure concentrations from 0 to 0.5 foot deep.

^b Maximum soil exposure concentrations from 0 to 2 feet deep.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 3
Revision: 0
Date: April 1996

Ingestion of Soil Invertebrates

The American robin, like most members of the thrush family (Turdinae), is primarily a ground forager and feeds on fruits, insects and earthworms (Graber et al., 1971). For this assessment potential exposure to the robin from chemicals of concern in its diet was evaluated based on the consumption of earthworms. Although the diet of the robin does not consist entirely of earthworms, for this assessment it is assumed that earthworms are the primary source of all dietary exposure. The primary reasons for making this assumption are: (1) the earthworm is one of the few invertebrates for which chemical uptake can be estimated, and (2) earthworms would be expected to significantly bioaccumulate chemicals found in the soil as a result of both dermal absorption and soil ingestion.

The model and assumptions used to estimate daily doses for the robin based on ingestion of chemicals of concern in invertebrates (i.e., earthworms) are shown in Table 3-13. In a study by Nagy (1987), field metabolic rates for approximately 10 species of passerine birds were analyzed. Body weights were strongly correlated to bird metabolic rates. In determining an appropriate ingestion rate for the robin, the following model from Nagy (1987) was used to represent the relationship between field metabolic rate and body weight:

$$\text{FMR} = 2.123\text{BW}^{0.749}$$

Where,

FMR = Field metabolic rate (kcal/day)

BW = Body weight (g)

Assuming an average robin body weight of 77 grams (Dunning, 1984), a field metabolic rate of approximately 55 kcal/day was calculated. In order to convert this field metabolic rate to an

Table 3-13
Estimated Daily Intake of Chemicals of Potential Concern
White-footed Mouse
Hamill Road Dump #3
Tennessee Products Site, Chattanooga, TN

Chemical	Estimated Daily Intake	
	Soil Ingestion Pathway ^a (mg/kg-day)	Seed Ingestion Pathway ^b (mg/kg-day)
Organics		
Aldrin	5.07E-06	1.79E-04
beta-BHC	1.48E-03	1.60E-02
delta-BHC	3.63E-04	3.00E-03
gamma-BHC	4.29E-04	4.63E-03
Carbazole	5.07E-04	5.21E-02
alpha-Chlordane	ND	3.55E-04
DDT	1.72E-04	4.96E-04
Dibenzofuran	2.18E-04	5.29E-03
Dieldrin	1.33E-03	2.31E-02
Endosulfan I	7.80E-04	1.34E-02
Endosulfan II	2.11E-04	3.30E-03
Endosulfan sulfate	1.21E-04	1.32E-03
Endrin	1.25E-04	1.40E-04
Heptachlor	3.59E-04	1.99E-03
Hexachlorobenzene	3.45E-04	1.41E-04
2-Methylnaphthalene	3.20E-04	2.61E-03
Naphthalene	7.02E-04	2.93E-02
PAHs		
Acenaphthylene	1.33E-03	8.55E-02
Anthracene	9.75E-03	2.84E-02
Benzo(a)anthracene	7.80E-02	8.64E-02
Benzo(a)pyrene	7.41E-02	3.50E-02
Benzo(b and/or k)fluoranthene	1.76E-01	1.07E-01
Benzo(g,h,i)perylene	4.29E-03	5.22E-03
Chrysene	8.97E-02	9.94E-02
Dibenzo(a,h)anthracene	1.95E-02	2.19E-02
Fluoranthene	1.52E-01	2.91E-01
Indeno(1,2,3-cd)pyrene	5.07E-02	1.70E-02
Phenanthrene	2.22E-02	1.05E-01
Pyrene	1.44E-01	2.83E-01
Styrene	7.80E-06	7.70E-04
1,1,1-Trichloroethane	1.36E-04	5.37E-03
Xylenes (total)	ND	3.20E-04
Inorganics		
Aluminum	5.02E+01	1.94E+00
Arsenic	4.29E-02	1.18E-02
Barium	4.81E-01	3.65E-01
Beryllium	ND	2.90E-04
Chromium (total)	3.13E-01	4.20E-02
Cobalt	6.64E-02	2.46E-02
Copper	2.09E-01	1.40E+00
Iron	8.19E+01	4.10E+00
Lead	2.89E-01	8.22E-02
Manganese	5.07E+00	1.95E+01
Mercury	1.29E-03	8.58E-03
Nickel	9.89E-02	2.81E-01
Selenium	8.19E-03	1.02E-02
Vanadium	9.75E-02	1.52E-02
Zinc	5.46E-01	1.64E+01
Cyanide	4.99E-03	1.68E-01

ND = Not detected in associated medium.

^a Maximum soil exposure concentrations from 0 to 0.5 foot deep.

^b Maximum soil exposure concentrations from 0 to 2 feet deep.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 3
Revision: 0
Date: April 1996

ingestion rate, information on the energy content in earthworms was used. The gross energy content of earthworms is approximately 4.6 kcal/g dry weight (EPA, 1993a). The amount of metabolizable energy in an earthworm is equal to the gross energy multiplied by an assimilation efficiency factor. Although an assimilation efficiency factor was not available for earthworms, assimilation efficiency values of 72-79% have been reported for animal matter in the diet of birds (EPA, 1993a). The midpoint of these range of values (76%) was assumed for earthworms. Thus, the amount of metabolizable energy in an earthworm was estimated to be 3.5 kcal/g dry weight. Based on this information, a dry weight ingestion rate of 16 g/day was estimated for the robin (i.e., $55 \text{ kcal/day} \div 3.5 \text{ kcal/g}$). The calculation of chemical concentrations in earthworms is presented in Appendix C.

The dietary intake of the robin is assumed to occur solely in contaminated areas for each of the sites, because the robin's home range of 0.11 to 0.75 acres is less than the area of the tar dumps at the site (Collins and Boyajan, 1965; Young, 1951).

Incidental Ingestion of Soil

The robin may ingest soil inadvertently while consuming earthworms and other ground-dwelling prey, and while preening. The model and assumptions used to calculate a soil ingestion dose for the robin are presented in Table 3-13.

Data regarding the incidental soil ingestion rate of the American robin were not available. EPA (1993a) reports that the percent soil in the diet of a woodcock, which feeds extensively on earthworms is approximately 10.4%. EPA (1993a) further suggests that other species that ingest earthworms might be expected to have similar soil intakes. A best estimate of 10.4% of the dry weight dietary ingestion rate was used for the robin's incidental soil ingestion rate. A soil

ingestion rate of 1.7 g dry weight/day was assumed for the robin based on a dietary intake of 16 g dry weight/day.

Total Exposure to the American Robin

Based on the previous discussion, the total exposure of the robin to chemicals from the site was derived as follows:

$$\text{Dose}_{\text{Total}} = \text{Dose}_{\text{worm}} + \text{Dose}_{\text{soil}}$$

Where:

$\text{Dose}_{\text{Total}}$	=	Total dose (mg/kg-day).
$\text{Dose}_{\text{worm}}$	=	Dose from ingestion of earthworms (mg/kg-day).
$\text{Dose}_{\text{soil}}$	=	Dose from soil ingestion (mg/kg-day).

The total and route-specific exposure doses estimated for the robin are presented in Tables 3-14 and 3-15 for the Tar Dump and Hamill Road Dump No. 3, respectively.

3.3.4 Muskrat

The primary routes of potential on-site exposure for the muskrat include the ingestion of clams and the ingestion of surface water. The methodology used to calculate the various exposures to the muskrat and the associated assumptions are presented in the following paragraphs.

Ingestion of Clams

Musk rats are primarily herbivorous, but some populations are more omnivorous (EPA, 1993a). They feed on various portions of aquatic plants including roots, stems, leaves, shoots, and

Table 3-14

**Model for Estimating Daily Intake by an American Robin
Tennessee Products Site, Chattanooga, TN**

$$EDI_{total} = EDI_{soil} + EDI_{soil\ invertebrates}$$

and

$$EDI_{soil} = \frac{CS \times SIR \times FI}{BW \times CF}$$

$$EDI_{soil\ invertebrates} = \frac{CI \times IIR \times FI}{BW \times CF}$$

where:

EDI_{total}	=	Total estimated daily intake (mg/kg-day).
EDI_{soil}	=	Estimated daily intake through soil ingestion (mg/kg-day).
$EDI_{soil\ invertebrates}$	=	Estimated daily intake through soil invertebrate ingestion (mg/kg-day).
CS	=	Chemical concentration in soil (mg/kg).
CI	=	Chemical concentration in invertebrate (mg/kg).
SIR	=	Soil ingestion rate - 1.7 g dry weight/day; assumed to be 10.4% of food intake based on the woodcock, another species that feeds extensively on earthworms (EPA, 1993a).
IIR	=	Invertebrate ingestion rate - 16 g dry weight/day (Nagy, 1987; EPA, 1993a).
FI	=	Fraction ingested from contaminated source - 1; the home range of the robin, 0.11 to 0.75 acre (Collins and Boyajian, 1965; Young, 1951), falls within the area of the site.
BW	=	Body weight - 0.077 kg (Dunning, 1984).
CF	=	Conversion factor - 1,000 g/kg.

Table 3-15
Estimated Daily Intake of Chemicals of Potential Concern
American Robin
Tar Dump
Tennessee Products Site, Chattanooga, TN

Chemical	Estimated Daily Intake	
	Soil Ingestion Pathway ^a (mg/kg-day)	Earthworm Ingestion Pathway ^b (mg/kg-day)
Organics		
Acetone	1.99E+00	NC
Aldrin	ND	1.92E-03
alpha - BHC	1.88E-02	2.57E+00
beta-BHC	9.94E-03	2.56E+00
delta-BHC	5.74E-03	1.07E+00
gamma-BHC	6.30E-03	8.96E-01
Carbazole	5.96E-03	NC
alpha-Chlordane	ND	3.74E-02
gamma-Chlordane	1.55E-03	3.24E-02
DDD	ND	4.42E-02
DDT	ND	1.72E-02
Dibenzofuran	ND	NC
Dieldrin	8.61E-02	8.02E+00
Endosulfan I	2.21E-03	NC
Endosulfan II	2.43E-03	NC
Endrin	ND	2.83E-02
Endrin aldehyde	1.92E-03	NC
Heptachlor	6.62E-03	NC
Heptachlor epoxide	1.94E-03	4.59E-02
Hexachlorobenzene	8.56E-03	NC
Methoxychlor	ND	5.76E-01
2-Methylnaphthalene	3.97E-03	NC
Naphthalene	8.17E-03	2.01E-02
PAHs		
Acenaphthylene	4.64E-02	7.66E-02
Anthracene	3.75E-02	9.05E-02
Benzo(a)anthracene	2.57E-01	8.63E-01
Benzo(a)pyrene	3.06E-01	1.58E+00
Benzo(b and/or k)fluoranthene	6.89E-01	1.54E+00
Benzo(g,h,i)perylene	1.42E-01	2.76E-01
Chrysene	2.69E-01	1.45E+00
Dibenzo(a,h)anthracene	1.19E-01	6.51E-01
Fluoranthene	2.87E-01	1.57E+00
Indeno(1,2,3-cd)pyrene	2.65E-01	1.05E+00
Phenanthrene	5.30E-02	2.27E-01
Pyrene	2.81E-01	1.32E+00
Tetrachloroethene	8.83E-05	NC
1,1,1-Trichloroethane	6.62E-05	NC
Trichloroethylene	4.42E-05	NC
Xylenes (total)	ND	NC
Inorganics		
Aluminum	3.09E+02	8.05E+02
Arsenic	1.89E-01	9.50E-02
Barium	2.98E+00	8.72E+00
Beryllium	ND	NC
Cadmium	ND	3.54E-01
Chromium (total)	3.75E+00	2.93E+01
Cobalt	3.66E-01	NC
Copper	6.86E-01	2.63E+00
Iron	4.34E+02	1.47E+03
Lead	2.87E+00	9.11E+00
Manganese	1.83E+01	1.86E+01
Mercury	1.74E-02	5.99E-02
Nickel	5.91E-01	1.20E+01
Selenium	ND	NC
Silver	2.80E-01	NC
Vanadium	5.33E-01	NC
Zinc	4.59E+00	3.61E+02
Cyanide	ND	NC

NC = Not calculated due to the lack of appropriate accumulation data.

ND = Not detected in associated medium.

^a Maximum soil exposure concentrations from 0 to 0.5 foot deep.

^b Maximum soil exposure concentrations from 0 to 2 feet deep.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 3
Revision: 0
Date: April 1996

tubers.—Animal foods such as fish, freshwater mussels and clams, insects, crayfish, and snails are also eaten. Muskrat foods and feeding habits vary widely and depend on habitat, season, and availability. Studies have shown that muskrats inhabiting lakes, reservoirs, and streams are opportunistic feeders, and may feed on more animal matter than marsh muskrats (Chapman and Feldhamer, 1982). For this assessment, potential exposure to the muskrat from chemicals of potential concern in its daily diet was evaluated for the consumption of clams. Sufficient information does not exist with which to estimate chemical uptake into aquatic plants.

The exposure doses to the muskrat through ingestion of clams was determined using the approach and assumptions as presented in Table 3-16. The daily food ingestion rate for the muskrat was assumed to be 0.30 g wet weight/g body weight per day based on information for male and female muskrats (EPA, 1993a). Assuming a mean body weight of 1160 grams for an adult muskrat (EPA, 1993a), a wet weight ingestion rate of 350 grams per day was estimated.

The home range of the muskrat ranges from 33 to 600 feet (Merritt, 1987). Since this falls within the study area of the creek (1 mile), it was assumed that 100% of the muskrat's forage would be obtained from within the creek.

Ingestion of Water

The muskrat may also be exposed to chemical through the ingestion of water from Chattanooga Creek. The model and assumptions used to estimate exposure doses to the muskrat through surface water ingestion is presented in Table 3-16.

The surface water ingestion rate for the muskrat was estimated using the following allometric equation developed to estimated water intake for mammals (EPA, 1993a):

Table 3-16
Estimated Daily Intake of Chemicals of Potential Concern
American Robin
Hamill Road Dump #3
Tennessee Products Site, Chattanooga, TN

Chemical	Estimated Daily Intake	
	Soil Ingestion Pathway ^a (mg/kg-day)	Earthworm Ingestion Pathway ^b (mg/kg-day)
<i>Organics</i>		
Aldrin	2.87E-05	8.91E-04
beta-BHC	8.39E-03	7.98E-01
delta-BHC	2.05E-03	1.95E-01
gamma-BHC	2.43E-03	2.31E-01
Carbazole	2.87E-03	NC
alpha-Chlordane	ND	1.97E-03
DDT	9.71E-04	9.69E-02
Dibenzofuran	1.24E-03	NC
Dieldrin	7.51E-03	6.99E-01
Endosulfan I	4.42E-03	NC
Endosulfan II	1.19E-03	NC
Endosulfan sulfate	6.84E-04	NC
Endrin	7.06E-04	2.39E-02
Heptachlor	2.03E-03	NC
Hexachlorobenzene	1.95E-03	NC
2-Methylnaphthalene	1.81E-03	NC
Naphthalene	3.97E-03	1.48E-02
<i>PAHs</i>		
Acenaphthylene	7.51E-03	7.31E-02
Anthracene	5.52E-02	1.05E-01
Benzo(a)anthracene	4.42E-01	1.12E+00
Benzo(a)pyrene	4.19E-01	1.34E+00
Benzo(b and/or k)fluoranthene	9.94E-01	1.96E+00
Benzo(g,h,i)perylene	2.43E-02	1.25E-01
Chrysene	5.08E-01	2.10E+00
Dibenzo(a,h)anthracene	1.10E-01	5.09E-01
Fluoranthene	8.61E-01	3.00E+00
Indeno(1,2,3-cd)pyrene	2.87E-01	1.11E+00
Phenanthrene	1.26E-01	3.32E-01
Pyrene	8.17E-01	3.00E+00
Styrene	4.42E-05	NC
1,1,1-Trichloroethane	7.72E-04	NC
Xylenes (total)	ND	NC
<i>Inorganics</i>		
Aluminum	2.84E+02	1.08E+03
Arsenic	2.43E-01	1.01E-01
Barium	2.72E+00	9.34E+00
Beryllium	ND	NC
Chromium (total)	1.77E+00	7.65E+00
Cobalt	3.76E-01	NC
Copper	1.18E+00	2.62E+00
Iron	4.64E+02	1.66E+03
Lead	1.63E+00	5.16E+00
Manganese	2.87E+01	4.57E+01
Mercury	7.29E-03	1.67E-02
Nickel	5.60E-01	8.99E+00
Selenium	4.64E-02	NC
Vanadium	5.52E-01	NC
Zinc	3.09E+00	1.92E+02
Cyanide	2.83E-02	NC

NC = Not calculated due to the lack of appropriate accumulation data.

ND = Not detected in associated medium.

^a Maximum soil exposure concentrations from 0 to 0.5 foot deep.

^b Maximum soil exposure concentrations from 0 to 2 feet deep.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 3
Revision: 0
Date: April 1996

$$\text{Water Intake (L/day)} = 0.099BW^{0.90}$$

where, BW equals the body weight in kilograms. Using a body weight of 1.16 kg, a surface water ingestion rate of 0.11 L/day was calculated.

Total Exposure to the Muskrat

Based on the previous discussion, the total exposure of the muskrat to chemicals from the site was derived as follows:

$$\text{Dose}_{\text{Total}} = \text{Dose}_{\text{Clam}} + \text{Dose}_{\text{Surface water}}$$

Where:

$$\begin{aligned}\text{Dose}_{\text{Total}} &= \text{Total dose (mg/kg-day).} \\ \text{Dose}_{\text{Clam}} &= \text{Dose from ingestion of clams (mg/kg-day).} \\ \text{Dose}_{\text{Surface water}} &= \text{Dose from surface water ingestion (mg/kg-day).}\end{aligned}$$

Table 3-17 presents the model for estimating daily intake by a muskrat. The total and route-specific exposure doses estimated for the muskrat are presented in Table 3-18.

Table 3-17

**Model for Estimating Daily Intake by a Muskrat
Tennessee Products Site, Chattanooga, TN**

$$EDI_{total} = EDI_{surfacewater} + EDI_{clams}$$

and

$$EDI_{surface\ water} = \frac{CW \times WIR \times FI}{BW}$$

$$EDI_{clams} = \frac{CC \times CIR \times FI}{BW \times CF}$$

where:

EDI_{total}	=	Total estimated daily intake (mg/kg-day).
$EDI_{surface\ water}$	=	Estimated daily intake through surface water ingestion (mg/kg-day).
EDI_{clams}	=	Estimated daily intake through clam ingestion (mg/kg-day).
CW	=	Chemical concentration in surface water (mg/L).
CC	=	Chemical concentration in clams (mg/kg wet weight).
WIR	=	Water ingestion rate - 0.11 L/day; based on $0.099 \times BW^{0.9}$ (EPA, 1993a).
CIR	=	Clam ingestion rate - 350 g wet weight/day (EPA, 1993a).
FI	=	Fraction ingested from contaminated source - 1; the home range of the muskrat, 33 to 600 feet (Merritt, 1987), falls within the study area of the Chattanooga Creek.
BW	=	Body weight - 1.16 kg (EPA, 1993a).
CF	=	Conversion factor - 1,000 g/kg.

Table 3-18
Estimated Daily Intake of Chemicals of Potential Concern
Muskrat
Chattanooga Creek
Tennessee Products Site, Chattanooga, TN

Chemical	Estimated Daily Intake	
	Clam Ingestion Pathway (mg/kg-day)	Surface Water Ingestion Pathway (mg/kg-day)
<i>Organics</i>		
Bis(2-ethylhexyl)phthalate	ND	8.12E-04
<i>PAHs</i>		
Benzo(a)anthracene	5.43E-05	ND
Chrysene	5.43E-05	ND
Fluoranthene	9.05E-05	ND
<i>Inorganics</i>		
Aluminum	5.43E+01	3.70E-02
Arsenic	4.53E-01	ND
Barium	7.24E-01	2.84E-03
Cobalt	1.06E-01	ND
Copper	4.22E+00	3.89E-04
Iron	9.05E+01	9.39E-02
Manganese	7.54E+00	2.56E-02
Mercury	7.24E-03	ND
Nickel	2.29E-01	ND
Selenium	3.92E-01	ND
Strontium	3.62E-01	7.59E-03
Titanium	3.62E-01	9.39E-04
Vanadium	7.54E-02	ND
Zinc	1.06E+01	9.48E-04

ND = Not detected in associated medium.

SECTION 4

ECOLOGICAL EFFECTS CHARACTERIZATION

In the ecological effects characterization, information on the toxicity of the chemicals of potential concern to ecological receptors is presented. The toxicity information is used in the development of reference toxicity values (RTVs) (i.e., acceptable daily doses or media concentrations) for selected indicator species. A comprehensive literature and database search was performed to identify relevant toxicological data for the receptors. The data sources that were reviewed included:

- Federal/State Regulations and Guidance
- PHYTOTOX database
- ENVIROFATE database
- Hazardous Substance Database (HSDB)
- Registry of Toxic Effects of Chemical Substances (RTECs)
- Integrated Risk Information System (IRIS) - (non gavage studies)
- U.S. Fish and Wildlife Service Technical Reports.
- Chemical Abstracts (CA Service)

In addition to these databases, toxicity information was obtained from a variety of primary literature sources as presented throughout the following subsections.

4.1 TOXICITY TO AQUATIC LIFE

4.1.1 Surface Water

The toxicity of chemicals of potential concern in surface water was assessed by comparing surface water concentrations in Chattanooga Creek to EPA Region 4 Freshwater Surface Water Screening Values (EPA Region 4, 1995a). Both acute and chronic screening values have been

Ecological Risk Assessment
Tennessee Products Site
Section: Section 4
Revision: 0
Date: April 1996

developed by EPA Region 4, and are the same as the Federal Ambient Water Quality Criteria (AWQC), where available. If insufficient data were available to derive a criterion, the screening values were based on the lowest reported effect level with an applied safety factor of ten to protect for more sensitive species. Of the screening values reported for the contaminants of potential concern, aluminum, copper, iron, and zinc are based on EPA AWQC for the protection of aquatic life. EPA's criteria for copper and zinc have also been adopted by the State of Tennessee. Where sufficient data are available, EPA's AWQC are developed to protect 95% of all aquatic life including fish, aquatic invertebrates, and plants. The EPA Region 4 Screening Values used to assess water quality for the COPCs are presented in Table 4-1.

4.1.2 Sediment

The toxicity of chemicals of potential concern identified in Chattanooga Creek sediments to benthic and epibenthic life was assessed by the following methods:

- Conducting site-specific sediment toxicity tests with *Ceriodaphnia*.
- Conducting site-specific Microtox tests using sediment pore water.
- Comparing sediment contaminant concentrations to EPA Region 4 Sediment Effect Values, Ontario's Sediment Quality Guidelines, and EPA's Sediment Quality Criteria.

These methods are described in more detail in the following paragraphs.

Table 4-1
EPA Region 4 Freshwater Surface Water Screening Values

Chemical	Chronic Screening Values (Organics-ug/L) (Inorganics-mg/L)	Acute Screening Value (Organics-ug/L) (Inorganics-mg/L)
<i>Organics</i>		
Bis(2-ethylhexyl)phthalate	0.3	1110
<i>Inorganics</i>		
Aluminum	0.087	0.75
Barium	NA	NA
Copper	9.6 a	14 a
Iron	1	NA
Manganese	NA	NA
Strontium	NA	NA
Titanium	NA	NA
Zinc	86 a	95 a

a = Hardness dependent criteria, calculated using a hardness of 78 ppm.
 NA = Criteria not available

Ecological Risk Assessment
Tennessee Products Site
Section: Section 4
Revision: 0
Date: April 1996

Sediment Toxicity Tests

A *Ceriodaphnia dubia* (cladoceran) 7-day chronic test was conducted using whole sediment samples. The test was run on sediment samples collected at all of the 9 sediment sampling locations in Chattanooga Creek (see Figure 2-2), plus a laboratory control. The endpoints evaluated were survival and reproduction (average number of young). *Ceriodaphnia* were exposed in a static renewal system, using 10 organisms per test concentration, and 10 replicate test chambers per concentration. The test results are shown in Table 4-2, and indicate that adult survival and reproduction were significantly lower for sediment collected at sampling locations DC-1 and DC-5U. The toxicity was particularly great in DC-5U where 0% adult survival and reproduction was observed.

Microtox Tests

A Microtox test was run using sediment decantation (pore water). The test was run on pore water from sediments collected at 4 locations on Chattanooga Creek (DC-5U, DC-6U, DC-7U, and upgradient sample DC-8U), plus a laboratory control. The Microtox test measures the light output of luminescent bacteria (*Photobacterium phosphoreum*) before and after they are exposed to a sample of unknown toxicity. The degree of light loss indicates the degree of toxicity of the sample. The results are expressed as an EC50 (Effective Concentration). The Effective Concentration is the sample concentration that causes 50% reduction of light output after a 15 minute exposure. The test results are shown in Table 4-2, and indicate that light inhibition is occurring in sediment sample DC-5U.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 4
Revision: 0
Date: April 1996

Table 4-2

**Sediment Toxicity Testing Results
Tennessee Products Site, Chattanooga, TN**

Sediment Sample ID	Ceriodaphnia 7-day Chronic Test ^a		Microtox EC50 ^b (% Sample)
	Adult Survival	Average # of Young	
DC-1	4 ^c	9.8 ^c	
DC-2	10	14.4	
DC-3U	8	23.9	
DC-4U	8	17.6	
DC-5U	0 ^c	0 ^c	5.29
DC-6U	8	22.4	> 100
DC-7U	6	19.8	> 100
DC-8U	6	19.7	> 100
DC-9U	10	20.1	
Control	9	21.1	> 100
Reference Toxicant (phenol)			19.71

^a Conducted using whole sediments

^b Conducted using sediment pore water. EC50 represents 50% reduction in light emissions.

^c Indicates value is significantly different from control value (at p=0.05)

Ecological Risk Assessment
Tennessee Products Site
Section: Section 4
Revision: 0
Date: April 1996

Sediment Quality Guidelines/Criteria

EPA Region 4 has developed Sediment Screening Values from statistical interpretations of effects databases obtained from the literature as reported in publications from the State of Florida, the National Oceanic and Atmospheric Administration, and a joint publication by Long et al. (EPA Region 4, 1995a). These values are generally based on observations of direct toxicity. However, when the Contract Laboratory Program's practical quantification limit (PQL) is above the effect level, the screening value defaults to the PQL. For purposes of this risk assessment, the sediment concentrations from the site were only compared to the Sediment Effects Value, and do not consider PQLs. Where sediment effect values were not provided by EPA Region 4, but were available from Ontario's *Guidelines for the Protection and Management of Aquatic Sediment Quality* (OMOE, 1993), these values were also used for comparison. Ontario's Lowest Effect Levels (LELs) were used, and represent the level at which actual ecotoxic effects become apparent. The EPA Region 4 Sediment Effect Values and Ontario's LELs are presented in Table 4-3 for the contaminants of potential concern. In addition to these values, EPA has developed Sediment Quality Criteria for 5 organic compounds, 4 of which were detected in site sediments, and include acenaphthene, dieldrin, fluoranthene, and phenanthrene (EPA, 1993 b,c,d,e). Although EPA Region 4 has already provided Sediment Effect Values for these compounds, these criteria are presented for comparison purposes. EPA's sediment criteria for the COPCs are presented in Table 4-4 for different organic carbon levels.

4.2 TOXICITY TO TERRESTRIAL WILDLIFE

In deriving RTVs for wildlife, many sources were reviewed, often providing exposure data associated with a variety of toxicity endpoints (i.e., LOAEL, NOAEL, LD₅₀) and effects (i.e., neurotoxicity, developmental toxicity, death). The toxicity values used in the assessment were

**Table 4-3
Sediment Effect Values**

Chemical	Sediment Effect Values a (Organics-µg/kg) (Inorganics-mg/kg)	Source
<i>Organics</i>		
Acetone	NA	---
alpha - BHC	6.00E+00	OMOE, 1993
beta-BHC	5.00E+00	OMOE, 1993
delta-BHC	NA	---
gamma-BHC	3.20E-01	EPA Reg. 4, 1995a
Carbazole	NA	---
Chlorobenzene	NA	---
o-Chlorotoluene	NA	---
p-Chlorotoluene	NA	---
Dibenzofuran	NA	---
1,2-Dichlorobenzene	NA	---
1,4-Dichlorobenzene	NA	---
Dieldrin	2.00E-02	EPA Reg. 4, 1995a
Endosulfan I	NA	---
Endosulfan II	NA	---
Ethylbenzene	NA	---
Heptachlor epoxide	5.00E+00	OMOE, 1993
Hexachlorobenzene	2.00E+01	OMOE, 1993
Methoxychlor	NA	---
2-Methylnaphthalene	2.02E+01	EPA Reg. 4, 1995a
(3- and/or 4-)Methylphenol	NA	---
Naphthalene	3.46E+01	EPA Reg. 4, 1995a
<i>PAHs</i>		
Acenaphthene	6.71E+00	EPA Reg. 4, 1995a
Acenaphthylene	5.87E+00	EPA Reg. 4, 1995a
Anthracene	4.69E+01	EPA Reg. 4, 1995a
Benzo(a)anthracene	7.48E+01	EPA Reg. 4, 1995a
Benzo(b and/or k) fluoranthene	2.40E+02	OMOE, 1993
Benzo(g,h,i)perylene	1.70E+02	OMOE, 1993
Benzo(a)pyrene	8.88E+01	EPA Reg. 4, 1995a
Chrysene	1.08E+02	EPA Reg. 4, 1995a
Dibenzo(a,h)anthracene	6.22E+00	EPA Reg. 4, 1995a
Fluoranthene	1.13E+02	EPA Reg. 4, 1995a
Fluorene	2.12E+01	EPA Reg. 4, 1995a
Indeno(1,2,3-cd)pyrene	2.00E+02	OMOE, 1993
Phenanthrene	8.67E+01	EPA Reg. 4, 1995a
Pyrene	1.53E+02	EPA Reg. 4, 1995a
Toluene	NA	---
Xylene	NA	---
<i>Inorganics</i>		
Aluminum	NA	---
Arsenic	7.24E+00	EPA Reg. 4, 1995a
Barium	NA	---
Beryllium	NA	---
Cobalt	5.00E+01	OMOE, 1993
Copper	1.87E+01	EPA Reg. 4, 1995a
Iron	2.00E+04	OMOE, 1993
Lead	3.02E+01	EPA Reg. 4, 1995a
Magnesium	NA	---
Manganese	4.60E+02	OMOE, 1993
Mercury	1.30E-01	EPA Reg. 4, 1995a
Molybdenum	NA	---
Nickel	1.59E+01	EPA Reg. 4, 1995a
Strontium	NA	---
Titanium	NA	---
Vanadium	NA	---
Yttrium	NA	---
Zinc	1.24E+02	EPA Reg. 4, 1995a

a The sediment values reported for the Ontario Ministry of the Environment (OMOE)
are Lowest Effect Levels.
NA = Criteria not available

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 4
Revision: 0
Date: April 1996

Table 4-4

EPA Sediment Quality Criteria

Chemical	Sediment quality Criteria (mg/kg) by % Total Organic Carbon					
	1%	2%	3%	4%	5%	10%
Dieldrin	0.11	0.22	0.33	0.44	0.55	1.1
Fluoranthene	6.2	12.4	18.6	24.8	31	62
Acenaphthene	1.3	2.6	3.9	5.2	6.5	13
Phenanthrene	1.8	3.6	5.4	7.2	9	18

Ecological Risk Assessment
Tennessee Products Site
Section: Section 4
Revision: 0
Date: April 1996

those that exhibit the lowest exposure doses reported to be toxic or the highest doses associated with no adverse effects. If a dose reported to be toxic was used as the basis of the RTV, it was extrapolated to a no effect dose.

The process of selecting an appropriate toxicity endpoint for use in the RTV derivation requires guidelines for determining the appropriateness of specific endpoints. In general, effects that have apparent ecological implications were preferentially used. Thus, preference was given to endpoints such as reproductive effects (e.g., decreased fertility, teratogenicity, developmental effects, and fetal reabsorption) and mortality of adults or offspring, both of which would impact the species population. Preference was also given to serious histopathological effects (necrosis or other damage to target organs tissues: liver, kidney, brain/central nervous system, lungs, stomach, pancreas, etc.) that would impact primary body functions. In the absence of these preferred data, consideration was also given to effects such as alteration in biochemical functions of organs that could be correlated with decreased survivability (e.g., acetylcholinesterase function), as well as alteration in normal behavior that may result in decreased survivability of a receptor (e.g., impaired motor skills, increased reaction time, altered feeding habits). Other types of effects data such as increased body weight, decreased liver size, increased blood lead, which are not readily associated with decreased survivability or longevity, were only used in the absence of preferred toxicity data.

In deriving RTVs, data for chronic toxicity were preferentially used, when available. The resulting RTV will thus protect for chronic effects. Chronic exposure has been defined by Suter (1993) as an extended exposure of an organism to a chemical, which is conventionally taken to include at least a tenth of the life span of the species. Although chronic studies, as defined here, were preferentially used in the assessment, some studies may fall into a subchronic category, in which the length of the study extends less than an tenth of the lifespan, but longer than what

Ecological Risk Assessment
Tennessee Products Site
Section: Section 4
Revision: 0
Date: April 1996

would be considered an acute exposure. Acute exposure is defined in this assessment as a brief exposure to a chemical, which refers to an instantaneous exposure (e.g., oral gavage) or continuous exposures of minutes to a few days (Suter, 1993). In the absence of chronic data, RTVs were derived based on available acute data, and thus protect for potential acute effects. Potential acute effects are discussed separately from chronic effects in the risk characterization.

Since toxicity data for terrestrial wildlife are not nearly as complete as that found for laboratory and aquatic species, extrapolation of toxicity data from other animal studies is often necessary. Because of the uncertainty associated with these extrapolations, safety factors are applied to toxicological data to derive RTVs. The approach taken to derive RTVs for this study is provided in Table 4-1.

For those chemicals for which only acute lethality values were available, RTVs were derived by dividing acute toxicity values by an appropriate safety factor. Based on the guidance provided by EPA, a median lethal dose (LD_{50}) was extrapolated to an acute toxicity threshold by dividing the LD_{50} by a safety factor of 5. This safety factor is based on an analysis of dose response data for pesticides. A dose response five times lower than the LD_{50} would be expected to result in a mortality rate of about 1% under typical conditions, and up to 10% when the responses in test populations are highly variable. Protection of 90 to 99 percent of a population is expected to provide an adequate margin of safety. Furthermore, Lewis et al. (1990) determined chemical-specific ratios between LD_{50} values and NOAELs for the same species in a total of 490 studies. The results of the evaluation by Lewis et al. indicated that a factor of 6 was adequate to protect 99.9 percent of the populations for 85 percent of all evaluated chemicals. Thus, dividing an LD_{50} by a factor of five to extrapolate to a NOAEL should be adequately protective of sensitive members of a given population.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 4
Revision: 0
Date: April 1996

A safety factor of 5 was applied in the extrapolation of a chronic lowest-observable-adverse-effect-level (LOAEL) to a chronic no-observable-adverse-effect-level (NOAEL). EPA recommends a factor of 1 to 10 when extrapolating from a chronic LOAEL to a chronic NOAEL (EPA, 1991b). Weil and McCollister (1963) examined ratios of LOAELs to NOAELs from chronic and subchronic studies. Their analysis showed that 96% (50 out of 52) of the ratios were less than or equal to 5 (Lewis et al., 1990).

When deriving RTVs based on acute and/or chronic effects, extrapolation of toxicity data from other animal studies is often necessary since toxicity data for wildlife are not nearly as complete as those found for aquatic species. For such extrapolations, it is preferable to use data from the most closely related species. A safety factor of 5 was applied to account for differences between toxicity test species and site-specific receptors. The safety factors previously discussed are summarized in Table 4-5. An example of the steps taken to derive an RTV for a receptor species from a chronic LOAEL for a different species is also presented in this table.

Using this methodology, the estimated RTVs for the Northern short-tailed shrew and the white-footed mouse are the same, and the estimated RTVs for the robin and song sparrow are the same. The RTVs for the mammalian and avian species are presented in Tables 4-6 and 4-7, respectively, along with the toxicity data used to calculate the RTVs.

4.3 TOXICITY TO TERRESTRIAL VEGETATION

There is currently no EPA guidance for quantitatively evaluating potential adverse effects to plants growing in contaminated soils. For this assessment, the phytotoxic potential of site-related chemicals was evaluated by comparing soil concentrations at the site to growth medium concentrations reported in the literature to cause adverse effects in plants. Soil concentrations

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 4
Revision: 0
Date: April 1996

Table 4-5

**Safety Factors Used to Derive Reference Toxicity Values for
Indicator Species**

Available Toxicity Endpoint	Target Toxicity Endpoint	Safety Factor
Acute Lethality (i.e., LD ₅₀)	Acute Toxicity Threshold	5
Chronic LOAEL	Chronic NOAEL	5
Within Phylogenetic Class Sensitivity (i.e., different species but same class)	Target Species Toxicity	5

For example, in developing a reference toxicity value for a least shrew when the only data available is a chronic LOAEL for a rat, the following steps would be taken:

Rat chronic LOAEL for Compound X = 500 mg/kg.

(1) Chronic LOAEL → Chronic NOAEL

$$\frac{500 \text{ mg/kg}}{5} = 100 \text{ mg/kg}$$

(2) Within Phylogenetic Class → Target Species RTV

$$\frac{100 \text{ mg/kg}}{5} = 20 \text{ mg/kg}$$

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table 4-6
Basis of the Mammalian Reference Toxicity Values (RTVs)
(mg/kg-day)

Chemical	Species	Toxicity Endpoint	Effect	Dose (mg/kg-day)	Reference	Applied Safety Factor	Mammalian RTVs (mg/kg-day)
Organics							
Acetone	Rat	Chronic NOAEL	No effect on spermatogenesis	9.00E+02	Dietz et al., 1991	5	1.8E+02
Aldrin	Rat	Chronic Effect Dose	Nephritis in females	2.50E-01	Reuber, 1980	25	1.0E-02
alpha-BHC	Mouse	Chronic NOAEL	No liver toxicity	1.30E+01	Ito et al., 1973	5	2.6E+00
beta-BHC	Rat	Chronic NOAEL	No reduced body weight gain, neurological effects, or hematological effects	2.50+00	Van Velsen et al., 1986	5	5.0E-01
delta-BHC	Mouse	Chronic NOAEL	No liver toxicity	3.25E+01	Ito et al., 1973	5	6.5E+00
gamma-BHC	Rat	Chronic NOAEL	No liver/kidney toxicity	3.30E-01	Zoecon Corp., 1983	5	6.6E-02
Bis(2-ethylhexyl)phthalate	Mouse	Chronic NOAEL	No offspring effects	6.50E+01	Tyl et al., 1988	5	1.3E+01
Carbazole	NDA	---	---	---	---	---	NTV
Chlordane	Mouse	Chronic NOAEL	No significant liver lesions	6.50E-01	Khasawinah and Grutsch, 1989	5	1.3E-01

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Chemical	Species	Toxicity Endpoint	Effect	Dose (mg/kg-day)	Reference	Applied Safety Factor	Mammalian RTVs (mg/kg-day)
DDD	Rat	Chronic Effect Dose	Decreased organ/body weight;suppressed immunity	1.21E+02	Hamid et al., 1974	25	4.8E+00
DDT	Rat	Chronic NOAEL	No growth effect on pups	1.00E+00	Clement and Okey, 1974	5	2.0E-01
Dibenzofuran	NDA	---	---	---	---	---	NTV
Dieldrin	Mouse	Chronic NOAEL	No significant pup mortality	3.30E-01	Virgo and Bellward, 1975	5	6.6E-02
Endosulfan I	Rat	Acute NOAEL	No liver enzyme induction	2.50E+00	Den Tonkelaar and Van Esch, 1974	5	5.0E-01
Endosulfan II	Rat	Acute NOAEL	No liver enzyme induction	2.50E+00	Den Tonkelaar and Van Esch, 1974	5	5.0E-01
Endosulfan Sulfate	Rat	Acute LD50	Mortality	1.80E+01	RTECS, 1993	25	7.2E-01
Endrin	Rat	Chronic NOAEL	No significant mortality	2.50E-01	Treon et al., 1955	5	5.0E-02
Endrin Aldehyde	NDA	---	---	---	---	---	NTV

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table 4-6 (Continued)

**Basis of the Mammalian Reference Toxicity Values (RTVs)
(mg/kg-day)**

Chemical	Species	Toxicity Endpoint	Effect	Dose (mg/kg-day)	Reference	Applied Safety Factor	Mammalian RTVs (mg/kg-day)
Heptachlor	Rat	Chronic Effect Dose	16% embryo survival, decreased fertility	2.50E-01	Green, 1970	25	1.0E-02
Heptachlor epoxide	Rat	Chronic NOAEL	No effects	2.50E-01	Dow Chemical Co., 1959	5	5.0E-02
Hexachlorobenzene	Rat	Chronic NOAEL	No liver toxicity	8.00E-02	IRIS, 1996	5	1.6E-02
2-Methylnaphthalene	NDA	---	---	---	---	---	NTV
Methoxychlor	Rat	Chronic Effect Dose	Reduced fertility, late onset of puberty	6.00E+01	Harris et al., 1974	25	2.4E+00
Naphthalene	Rat	Chronic No Effect Dose	Mortality	4.10E+01	Schmahl, 1955	5	8.2E+00
PAHs*	Mouse	Chronic No Effect Dose	No effect on reproduction/fertility	1.30E+02	Rigdon and Neal, 1965	5	2.6E+01
Styrene	Rat	Chronic No Effect Dose	No systemic toxic effects	2.10E+01	ATSDR, 1992b	5	4.2E+00
Tetrachloroethene	Rat	Chronic LOAEL	Decreased body weight in females, increase organ to body weight ratio	5.60E+01	Hayes et al., 1986	25	2.2E+00

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table 4-6 (Continued)

**Basis of the Mammalian Reference Toxicity Values (RTVs)
(mg/kg-day)**

Chemical	Species	Toxicity Endpoint	Effect	Dose (mg/kg-day)	Reference	Applied Safety Factor	Mammalian RTVs (mg/kg-day)
1,1,1-Trichloroethane	Mouse	Chronic No Effect Dose	Reproductive performance and mortality	1.00E+03	Lane et al., 1982	5	2.0E+02
Trichloroethene	Mouse	Chronic NOAEL	No liver, kidney, testis, pup weight effects	2.96E+02	NTP, 1985	5	5.9E+01
Xylenes	NDA	---	---	---	---	---	NTV
Inorganics							
Aluminum	Rat	Chronic No Effect Dose	No reproductive abnormalities in male rats	7.75E+01	Dixon et al., 1979	5	1.6E+01
Arsenic	Mouse	Chronic NOAEL	Decreased survival	6.25E+00	Schroeder and Balassa, 1967	5	1.3E+00
Barium	Mouse	Chronic NOAEL	No significant mortality or behavioral effects	1.83E+02	Dietz et al., 1992	5	3.7E+01
Beryllium	Rat	Acute Effect Dose	Rickets	6.25E+01	Guyatt et al., 1933	25	2.5E+00
Cadmium	Rat	Chronic NOAEL	No effect on motor or kidney function	1.64E+00	Kotsonis and Klaassen, 1978	5	3.3E-01

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table 4-6 (Continued)

**Basis of the Mammalian Reference Toxicity Values (RTVs)
(mg/kg-day)**

Chemical	Species	Toxicity Endpoint	Effect	Dose (mg/kg-day)	Reference	Applied Safety Factor	Mammalian RTVs (mg/kg-day)
Chromium	Mouse	Chronic No Effect Dose	No effect on hematology, organ weight, or reproduction	1.47E+03	Ivankovic et al., 1975	5	2.9E+02
Cobalt	Rat	Chronic NOAEL	No testicular atrophy	5.00E+00	Nation et al., 1983	5	1.0E+00
Copper	Mouse	Chronic NOAEL	No reproductive effects	2.60E+02	Lecyk, 1980	5	5.2E+01
Iron	NDA	---	---	---	---	---	NTV
Lead	Rat	Chronic NOAEL	No depressed immunity	4.60E+00	Luster et al., 1978	5	9.2E-01
Manganese	Rat	Chronic Effect Dose	Motor ability, aggressive behavior	1.40E+02	Chandra, 1983	25	5.6E+00
Mercury	Rat	Chronic NOAEL	Kidney enlargement	3.15E+01	Fitzhugh et al., 1950	5	6.3E+00
Nickel	Rat	Chronic Effect Dose	Increased number of young deaths and runts	7.00E-01	Schroeder and Mitchener, 1971	25	2.8E-02
Selenium	Mouse	Chronic NOAEL	No effects on fetal growth	3.75E-01	Nobunga et al., 1979	5	7.5E-02

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table 4-6 (Continued)

**Basis of the Mammalian Reference Toxicity Values (RTVs)
(mg/kg-day)**

Chemical	Species	Toxicity Endpoint	Effect	Dose (mg/kg-day)	Reference	Applied Safety Factor	Mammalian RTVs (mg/kg-day)
Silver	Rat	Chronic No Effect Dose	No effects	2.00E+01	Walker, 1971	5	4.0E+00
Strontium	Rat	Chronic No Effect Dose	No change in histology or bone calcium levels	2.67E+02	Skoryna and Fuskova, 1981	5	5.3E+01
Titanium	Rat	Chronic Effect Dose	Significant increase in young deaths	7.10E-01	Schroeder and Mitchener, 1971	25	2.8E-02
Vanadium	Mouse	Chronic NOAEL	No decreased motility, fertility	1.68E+01	Llobet et al., 1993	5	3.3E+00
Zinc	Rat	Chronic NOAEL	No reproductive effects	1.00E+02	Schlicker and Cox, 1968	5	2.0E+01
Cyanide	Rat	Chronic No Effect Dose	No gross signs of toxicity or histopathologic lesions	1.08E+01	IRIS, 1996	5	2.2E+00

NOAEL - No-observable-adverse-effect-level.

*This data is based on benzo(a)pyrene. The RTV for benzo(a)pyrene was applied to all PAHs.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table 4-7
Basis of the Avian Reference Toxicity Values (RTVs)
(mg/kg-day)

Chemical	Species	Toxicity Endpoint	Effect	Dose (mg/kg-day)	Reference	Applied Safety Factor	Avian RTV (mg/kg-day)
Organics							
Acetone	Japanese quail	Acute No Effect Dose	No overt signs of toxicity	1.41E+04	Hill and Camardese, 1986	5	2.8E+03
Aldrin	Mallard	Chronic LOAEL	Mortality	5.00E+00	Tucker and Crabtree, 1970	25	2.0E-01
alpha-BHC	NDA	---	---	---	---	---	NTV
beta-BHC	NDA	---	---	---	---	---	NTV
delta-BHC	NDA	---	---	---	---	---	NTV
gamma-BHC	Japanese quail	Acute LC50	Mortality	6.10E+01	Hill and Camardese, 1986	25	2.4E+00
Bis(2-ethylhexyl)phthalate	White Leghorn Chicken	Chronic Effect Dose	Decreased body weight and egg production, and cholesterol changes	5.64E+02	Wood and Bitman, 1980	25	2.3E+01

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table 4-7 (Continued)

**Basis of the Avian Reference Toxicity Values (RTVs)
(mg/kg-day)**

Chemical	Species	Toxicity Endpoint	Effect	Dose (mg/kg-day)	Reference	Applied Safety Factor	Avian RTV (mg/kg-day)
Carbazole	NDA	---	---	---	---	---	NTV
Chlordane	Bobwhite (chick)	Acute LC ₅₀	50 % mortality	5.22E+01	Heath et al., 1972	25	2.1E+00
DDD	Ring-necked pheasant	Acute LC ₅₀	50 % mortality	5.90E+01	Hill et al., 1975	25	2.4E+00
DDT	Mallard (adult)	Chronic NOAEL	No eggshell thinning	1.85E-01	Davison and Sell, 1974	5	3.7E-02
Dibenzofuran	NDA	---	---	---	---	---	NTV
Dieldrin	Bobwhite quail	Acute LC50	Mortality	6.00E+00	Heath et al., 1972	25	2.4E-01
Endosulfan I	Bobwhite quail (9-day-old)	Acute LC50	Mortality	1.88E+02	Hill et al., 1975	25	7.5E+00
Endosulfan II	Bobwhite quail (9-day-old)	Acute LC50	Mortality	1.88E+02	Hill et al., 1975	25	7.5E+00
Endosulfan sulfate	NDA	---	---	---	---	---	NTV

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table 4-7 (Continued)

**Basis of the Avian Reference Toxicity Values (RTVs)
(mg/kg-day)**

Chemical	Species	Toxicity Endpoint	Effect	Dose (mg/kg-day)	Reference	Applied Safety Factor	Avian RTV (mg/kg-day)
Endrin	Mallard	Chronic NOAEL	No reproductive effects	1.20E-01	Heath et al., 1972	5	2.4E-02
Endrin aldehyde	NDA	---	---	---	---	---	NTV
Heptachlor	Chicken (3-week-old)	Acute Effect Dose	State of stress (decreased body weight)	9.50E-02		25	3.8E-03
Heptachlor epoxide	NDA	---	---	---	---	---	NTV
Hexachlorobenzene	Quail	Chronic NOAEL	No effects on liver, kidney, neurological system, or egg production	1.00E-01	Verscheuren, 1983	5	2.0E-02
Methoxychlor	Japanese quail (14-day-old)	Acute No Effect Dose	No overt signs of toxicity	7.89E+02	Hill and Camardese, 1986	5	1.6E+02
2-Methylnaphthalene	NDA	---	---	---	---	---	NTV
Naphthalene	Bobwhite quail (13-day-old)	Acute NOAEL	Decreased body weight gain	3.47E+02	Wildlife International Ltd., 1985	5	6.9E+01
PAHs	NDA	---	---	---	---	---	NTV

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table 4-7 (Continued)

**Basis of the Avian Reference Toxicity Values (RTVs)
(mg/kg-day)**

Chemical	Species	Toxicity Endpoint	Effect	Dose (mg/kg-day)	Reference	Applied Safety Factor	Avian RTV (mg/kg-day)
Styrene	NDA	---	---	---	---	---	NTV
Tetrachloroethene	NDA	---	---	---	---	---	NTV
1,1,1-Trichloroethane	NDA	---	---	---	---	---	NTV
Trichloroethylene	NDA	---	---	---	---	---	NTV
Xylenes (total)	Japanese quail (14-day-old)	Acute NOAEL	No overt signs of toxicity	1.94E+03	Hill and Camardese, 1986	5	3.9E+02
Inorganics							
Aluminum	Japanese quail	Chronic NOAEL	Body weight/growth/egg production	2.60E+01	Hussein et al., 1988	5	5.2E+00
Arsenic	Mallard (1-day old)	Chronic NOAEL	No significant behavioral effects	2.89E+01	Whitworth et al., 1991	5	5.8E+00
Barium	NDA	---	---	---	---	---	NTV
Beryllium	NDA	---	---	---	---	---	NTV

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table 4-7 (Continued)

**Basis of the Avian Reference Toxicity Values (RTVs)
(mg/kg-day)**

Chemical	Species	Toxicity Endpoint	Effect	Dose (mg/kg-day)	Reference	Applied Safety Factor	Avian RTV (mg/kg-day)
Cadmium	Mallard	Chronic LOAEL	Egg production suppression	2.00E+01	White and Finley, 1978	25	8.0E-01
Chromium	Chicks (3-week old)	Chronic NOAEL	No effects on body weight or mortality	9.52E+01	Hill and Matrone, 1970	5	1.9E+01
Cobalt	NDA	---	---	---	---	---	NTV
Copper	Chicks (1-day old)	Chronic NOAEL	No significant mortality	5.60E+01	Mehring et al., 1960	5	1.1E+01
Iron	NDA	---	---	---	---	---	NTV
Lead	Japanese quail (chicks)	Chronic NOAEL	No anemia, no depressed growth	2.60E+01	Morgan et al., 1975	5	5.2E+00
Manganese	Turkey poults	Acute NOAEL	No effects on body weight	2.29E+02	Vohra and Kratzer, 1968	5	4.6E+01
Mercury	Japanese quail (< 1-year-old)	Chronic NOAEL	No reproductive effects	1.79E-01	Hill and Shaffner, 1976	5	3.6E-02

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table 4-7 (Continued)

**Basis of the Avian Reference Toxicity Values (RTVs)
(mg/kg-day)**

Chemical	Species	Toxicity Endpoint	Effect	Dose (mg/kg-day)	Reference	Applied Safety Factor	Avian RTV (mg/kg-day)
Nickel	Chicks (1-day old)	Acute NOAEL	No depressed weight gain	1.69E+01	Weber and Reid, 1968	5	3.4E+00
Selenium	Mallard	Chronic NOAEL	No reproductive effects	4.90E-01	Heinz et al., 1989	5	9.8E-02
Silver	Chicks (1-day-old)	Chronic Effect Dose	Increased mortality, depressed growth	8.60E+01	Peterson and Jensen, 1975	25	3.4E+00
Strontium	NDA	---	---	---	---	---	NTV
Titanium	NDA	---	---	---	---	---	NTV
Vanadium	White leghorn hens (15-month-old)	Chronic LOAEL	Decreased hatchability	3.30E+00	Berg et al., 1963	25	1.3E-01
Zinc	Chicks (1-day old)	Chronic NOAEL	No decrease in body weight or food consumption	2.53E+02	Oh et al., 1979	5	5.1E+01

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table 4-7 (Continued)

**Basis of the Avian Reference Toxicity Values (RTVs)
(mg/kg-day)**

Chemical	Species	Toxicity Endpoint	Effect	Dose (mg/kg-day)	Reference	Applied Safety Factor	Avian RTV (mg/kg-day)
Cyanide	Starling	Acute LD50	Mortality	9.00E+00	Wiemeyer et al., 1986	25	3.6E-01

NDA - No Data Available

NOAEL - No-observable-adverse-effect-level

LOAEL - Lowest-observable-adverse-effect-level

LD50 - Dose lethal to 50% of the test organisms

that did not result in any toxic effects in plants were also used as a basis of comparison, when available. Plant toxicity data are presented in Table 4-8.

4.4 TOXICITY TO SOIL INVERTEBRATES

There is currently no EPA guidance for quantitatively evaluating potential adverse effects to soil invertebrates inhabiting contaminated soils. For this assessment, potential toxicity to soil invertebrates from exposure to site-related chemicals was evaluated by conducting site-specific earthworm toxicity tests. The tests were 14-day static survival tests, in which earthworms (*Eisenia andrei*) were exposed to 5 site soil samples, 3 which were collected in the tar dump (SC-2U, SC-3M, SC-8L), and 2 which were collected in Hamill Road Dump No. 3 (SC-18U, SC-19L). The rationale for choosing these soil samples to run the toxicity test is presented in Table 4-9, along with the results of the earthworm toxicity test. The results show that no significant toxic effects were observed in any of the site-related soil samples.

Table 4-8
Summary of Available Plant Toxicity Values
Tennessee Products Site - Chattanooga, TN

Chemical	Medium or Soil Type	Plant Species	No Observed Effect Concentration ^a (mg/kg)	Lowest Observed Effect Concentration ^b (mg/kg)	Effect	Reference
<i>Organics</i>						
Aldrin	sandy loam	Bengal gram	---	1.00E+00	reduced nodulation	Kapoor et al., 1977
	sandy loam	Bengal gram	---	1.00E+01	reduced N fixation	Kapoor et al., 1977
	soil	corn	---	3.70E-01	10% decrease in size	Phytotox Database, 1996
beta-BHC	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
gamma-BHC	alluvial soil	groundnut	---	1.00E+00	reduced root nodulation	Misra and Gaur, 1974
	sand	pea plant	---	2.00E+00	reduced root length	Chametski et al., 1973
	sand	pea plant	---	4.00E+00	no secondary roots	Chametski et al., 1973
	sand	pea plant	---	8.00E+00	root cells vacuolated	Chametski et al., 1973
	alluvial soil	groundnut	---	1.00E+01	no root nodulation	Misra and Gaur, 1974
	sand	pea plant	---	3.00E+01	no cellular organization	Chametski et al., 1973
	alluvial soil	groundnut	---	1.00E+02	decrease in pod yield	Misra and Gaur, 1974
Chlordane	soil	turfgrass	---	3.25E+01	95% reduction in germin.	Phytotox Database, 1996
DDT	soil	bean	3.85E+01	---	no injury to shoots	Phytotox Database, 1996
Dieldrin	soil	corn	---	1.15E+00	plant size	Phytotox Database, 1996
Endosulfan	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
Heptachlor	soil	cotton	---	1.56E+04	decrease in plant yield	Phytotox Database, 1996
Naphthalene	agricultural loam	lettuce	---	1.00E+02	50% reduction in growth	Hulzebos et al., 1993
Tetrachloroethene	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
1,1,1-Trichloroethane	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
o-Xylene	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
<i>Inorganics</i>						
Aluminum	silt loam	white clover	---	5.00E+01	seedling establish	Will and Suter, 1994
Arsenic	sandy loam	cotton	---	1.12E+01	shoot weight	Will and Suter, 1994
	sandy loam	soybean	---	1.12E+01	shoot weight	Will and Suter, 1994
	black clay	soybean	---	2.24E+01	shoot weight	Will and Suter, 1994
	black clay	cotton	6.72E+01	8.96E+01	shoot weight	Will and Suter, 1994
	---	spruce	---	1.00E+03	height	Will and Suter, 1994
Barium	loam	barley	---	5.00E+02	plant weight	Will and Suter, 1994
	loam	bush beans	1.00E+03	2.00E+03	plant weight	Will and Suter, 1994

Table 4-8(continued)
Summary of Available Plant Toxicity Values
Tennessee Products Site - Chattanooga, TN

Chemical	Medium or Soil Type	Plant Species	No Observed Effect Concentration ^a (mg/kg)	Lowest Observed Effect Concentration ^b (mg/kg)	Effect	Reference
Beryllium	surface soil	---	---	1.00E+01	phytotoxic	Will and Suter, 1994
Cadmium ^c	soil+sand	spruce	1.00E+00	2.00E+00	root & shoot weight	Will and Suter, 1994
	sand +peat	soybean	1.25E+00	2.50E+00	plant weight	Will and Suter, 1994
	silt loam	soybean	1.00E+00	1.00E+01	shoot weight	Will and Suter, 1994
	sand +peat	soybean	5.00E+00	1.00E+01	plant weight	Will and Suter, 1994
	sandy loam	red oak	1.00E+01	2.00E+01	plant weight	Will and Suter, 1994
	sand	Kentucky bluegrass	1.00E+01	3.00E+01	root & shoot weight	Will and Suter, 1994
	alluvial	wheat	1.00E+01	3.00E+01	grain yield	Will and Suter, 1994
	humic sand	oats	1.00E+01	9.70E+01	fresh shoot weight	Will and Suter, 1994
	silt loam	rye	5.00E+01	1.00E+02	shoot weight	Will and Suter, 1994
	alluvial	rice	3.00E+01	1.00E+02	root & shoot weight	Will and Suter, 1994
	silt loam	soybean	1.00E+01	1.00E+02	shoot weight	Will and Suter, 1994
	loam	oats	1.00E+01	1.59E+02	leaf weight	Will and Suter, 1994
Chromium	loam	oats	3.50E+00	7.40E+00	fresh shoot weight	Will and Suter, 1994
	loam	soybean	1.00E+01	3.00E+01	fresh shoot weight	Will and Suter, 1994
	humic sand	oats	1.10E+01	3.10E+01	fresh shoot weight	Will and Suter, 1994
Cobalt	surface soil	---	---	2.50E+01	phytotoxic	Will and Suter, 1994
Copper	sand	blue stem	---	1.00E+02	root & shoot weight	Will and Suter, 1994
	sand	blue stem	---	1.00E+02	root & shoot weight	Will and Suter, 1994
	loam	bush beans	1.00E+02	2.00E+02	leaf weight	Will and Suter, 1994
Lead	silty clay loam	sycamore	---	5.00E+01	leaf weight	Will and Suter, 1994
	sandy loam	red oak	2.00E+01	5.00E+01	plant weight	Will and Suter, 1994
	soil+sand	spruce	5.00E+01	1.00E+02	root & shoot weight	Will and Suter, 1994
	soil:sand:peat	autumn olive	8.00E+01	1.60E+02	transpiration	Will and Suter, 1994
	sand	blue stem	---	4.50E+02	root & shoot weight	Will and Suter, 1994
	sand	blue stem	---	4.50E+02	root weight	Will and Suter, 1994
	brown earth	oats	1.00E+02	5.00E+02	root weight	Will and Suter, 1994
	brown earth	wheat	5.00E+02	1.00E+03	root weight	Will and Suter, 1994
	alluvial	wheat	3.00E+02	1.00E+03	root & shoot weight	Will and Suter, 1994
	silt loam	rye	1.00E+03	5.00E+03	shoot weight	Will and Suter, 1994
	silt loam	fescue	1.00E+03	5.00E+03	shoot weight	Will and Suter, 1994
Manganese	loam	bush beans	---	5.00E+02	stem weight	Will and Suter, 1994
Mercury	surface soil	---	---	3.00E-01	---	Will and Suter, 1994

Table 4-8(continued)
Summary of Available Plant Toxicity Values
Tennessee Products Site - Chattanooga, TN

Chemical	Medium or Soil Type	Plant Species	No Observed Effect Concentration ^a (mg/kg)	Lowest Observed Effect Concentration ^b (mg/kg)	Effect	Reference
Nickel	loam	barley	---	2.50E+01	shoot weight	Will and Suter, 1994
	sandy loam	red oak	2.00E+01	5.00E+01	plant weight	Will and Suter, 1994
	loam	bush beans	2.50E+01	1.00E+02	leaf weight	Will and Suter, 1994
	loam	bush beans	---	1.00E+02	shoot weight	Will and Suter, 1994
	loam	cotton	---	1.00E+02	leaf & stem weights	Will and Suter, 1994
	loam	ryegrass	9.00E+01	1.80E+02	shoot weight	Will and Suter, 1994
	loam	bush beans	1.00E+02	2.50E+02	shoot weight	Will and Suter, 1994
Selenium	loamy sand	sorghass	---	1.00E+00	shoot weight	Will and Suter, 1994
	sand	sorghass	---	1.00E+00	shoot weight	Will and Suter, 1994
	loamy sand	sorghass	---	1.00E+00	shoot weight	Will and Suter, 1994
	sand	sorghass	---	1.00E+00	shoot weight	Will and Suter, 1994
	sandy loam	alfalfa	5.00E-01	1.50E+00	shoot weight	Will and Suter, 1994
	clay loam	alfalfa	5.00E-01	1.50E+00	shoot weight	Will and Suter, 1994
	clay loam	alfalfa	5.00E-01	1.50E+00	shoot weight	Will and Suter, 1994
	sand	sorghass	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
	silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
	silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
	silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
	silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
	silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
	silty clay loam	alfalfa	2.00E+00	4.00E+00	shoot weight	Will and Suter, 1994
Silver	surface soil	---	---	2.00E+00	---	Will and Suter, 1994
Vanadium	surface soil	---	---	2.50E+00	phytotoxic	Will and Suter, 1994
	surface soil	---	---	5.00E+01	phytotoxic	Will and Suter, 1994
Zinc	sand:peat:soil	beech	---	3.30E+00	annual ring width	Will and Suter, 1994
	surface soil	soybean	1.00E+01	2.50E+01	seeds/plant	Will and Suter, 1994
	surface soil	coriander	---	8.70E+01	root & shoot weight	Will and Suter, 1994
	sandy loam	soybean	---	1.31E+02	leaf weight	Will and Suter, 1994
	sandy loam	soybean	---	3.93E+02	leaf weight	Will and Suter, 1994
	alluvial soil	wheat	---	1.00E+03	plant weight, grain yield	Will and Suter, 1994
	alluvial soil	rice	---	1.00E+03	root weight	Will and Suter, 1994

--- = No data available.

NTV = No plant toxicity values available.

^a No observed effect concentration (NOEC) is defined as the highest concentration which produced a reduction of 20% or less in a measured response.

^b Lowest observed effect concentration (LOEC) is defined as the lowest concentration which produced greater than a 20% reduction in a measured response. In some cases, the LOEC for a study was the lowest concentration tested or reported.

^c Due to the large number of phytotoxicity data available for cadmium, only results from studies containing both a NOEC and a LOEC were summarized.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 4
Revision: 0
Date: April 1996

Table 4-9

**Soil Toxicity Testing Results
Tennessee Products Site, Chattanooga, TN**

Soil Sample ID	Basis for Sample Selection	Earthworm % Survival
SC-2U	Moderate pesticide, high Hg, Zn	100
SC-18U	No pesticide, moderate Hg, Zn	100
SC-3M	High pesticide, high Hg, Zn	100
SC-8L	Moderate pesticides, no Hg, Zn	100
SC-19L	No pesticide, no Hg, Zn	97
Control	---	100
Reference toxicant (2-chloroacetamide)	---	0

SECTION 5

RISK CHARACTERIZATION

5.1 GENERAL APPROACH

The potential risk posed to ecological receptors (aquatic life, shrew, mouse, muskrat, robin, plants, and soil invertebrates) was assessed by evaluating the results of site-specific toxicity tests, as well as comparing estimated daily doses or media-specific concentrations with reference toxicity values. This comparison, described as a hazard quotient (HQ), was made for each chemical and is expressed as:

$$HQ = C_{med}/RTV_{med}$$

Where:

$$C_{med} = \text{Concentration of a chemical in a medium}$$

$$RTV_{med} = \text{Reference toxicity value for the same chemical in the same medium.}$$

or:

$$HQ = EDD/RTV_{ing}$$

Where:

$$EDD = \text{Estimated daily dose of a chemical through a specific exposure route (i.e., soil ingestion or food ingestion) (mg/kg-day).}$$

$$RTV_{ing} = \text{Reference toxicity value for the same chemical through the ingestion route (mg/kg-day).}$$

It is important to note that this methodology is not a measure of and cannot be used to determine quantitative risk, i.e., it does not predict the probability of adverse effects occurring. If the

Ecological Risk Assessment
Tennessee Products Site
Section: Section 5
Revision: 0
Date: April 1996

calculated hazard quotient (HQ) exceeds unity (i.e., >1), then it simply indicates that the species of concern may be at risk to an adverse effect from the particular chemical or exposure route on which the HQ was based. Because reference toxicity values incorporate a number of safety factors, if a reference toxicity value is exceeded, i.e., the hazard quotient exceeds unity, it does not necessarily indicate that an adverse effect will occur.

Exposures to the same chemical through multiple exposure routes are assumed to be cumulative. Consequently, a hazard index for a specific chemical (HI_{chem}) examines the potential for risk posed by a chemical through more than one exposure route, where applicable. For example, the cumulative hazard index for an individual chemical in all media was determined for the shrew as follows:

$$HI_{chem} = HQ_{worm} + HQ_{soil}$$

Where:

HI_{chem} = Hazard index for a chemical.

HQ_{worm} = Hazard quotient for the same chemical through ingestion of earthworms.

HQ_{soil} = Hazard quotient for the same chemical through soil ingestion.

As with the hazard quotient, a chemical-specific hazard index greater than 1 does not necessarily indicate that an adverse effect will occur.

To assess the potential for adverse effects to occur to plants, soil chemical data was compared to phytotoxicity data available in the literature. Since phytotoxicity data is often not species-specific, or is available for plant species that are not present at the site, an HQ was not

calculated. Rather, the phytotoxicity data, which were available for a variety of plant species, were compared to the soil chemical data.

The following is a discussion of the potential risks posed to aquatic life, terrestrial wildlife, plant life, and soil invertebrates for the chemicals of potential concern. The risk is specific to the previously presented exposure scenarios. Uncertainties associated with these risk estimates are discussed in Section 6.

5.2 RISK CHARACTERIZATION TO AQUATIC LIFE

5.2.1 Surface Water

Potential risks to aquatic life inhabiting the surface waters of Chattanooga Creek were assessed by comparing the surface water concentrations to the EPA Region 4 Freshwater Surface Water Screening Values. Comparisons were made with both acute and chronic screening values, as presented in Tables 5-1 and 5-2, respectively. The results show that none of the acute screening values were exceeded. The chronic screening values were exceeded for bis(2-ethylhexyl)phthalate at WC-5, aluminum at all locations (including background), and iron at WC-2. The greatest exceedance was for bis(2-ethylhexyl)phthalate at WC-5, resulting in a hazard quotient of 43. All other hazard quotients were below 6. Although the chronic aluminum screening value is exceeded at all locations, including background, it is not expected to result in adverse effects to aquatic life in Chattanooga Creek. This aluminum screening value (87 $\mu\text{g/L}$) is based on an AWQC which accounts for the protection of brook trout and striped bass, neither species of which is present in Chattanooga Creek, under conditions of soft and acidic waters, which enhances the toxicity of aluminum. EPA calculated a final chronic value of 748 $\mu\text{g/L}$ for aluminum before it was lowered to 87 $\mu\text{g/L}$ to protect for more sensitive species

Table 5-1
Surface Water Hazard Quotients - Acute
Tennessee Products Site, Chattanooga, TN

Chemical	EPA Region 4 Freshwater Surface Water Acute Screening Value (Organics-ug/L) (Inorganics-mg/L)	Hazard Quotient by Surface Water Sampling Location							
		WC-2	WC-3	WC-4	WC-5	WC-6	WC-7	WC-9	WC-8 Background
Organics									
Bis(2-ethylhexyl)phthalate	1.11E+03	ND	ND	ND	1.2E-02	ND	ND	ND	ND
Inorganics									
Aluminum	7.50E-01	6.5E-01	4.4E-01	4.3E-01	2.8E-01	2.4E-01	2.3E-01	2.5E-01	2.1E-01
Barium	NA	--	--	--	--	--	--	--	--
Copper	1.40E+01 a	2.9E-04	ND	ND	ND	ND	ND	ND	ND
Iron	NA	--	--	--	--	--	--	--	--
Manganese	NA	--	--	--	--	--	--	--	--
Strontium	NA	--	--	--	--	--	--	--	--
Titanium	NA	--	--	--	--	--	--	--	--
Zinc	9.50E+01 a	1.9E-04	4.3E-05	3.4E-05	2.7E-05	2.6E-05	3.2E-05	2.4E-05	2.7E-05

-- = Not applicable due to lack of criteria

NA = Criteria not available

ND = Not detected

^a Hardness dependent criteria, calculated using a hardness of 78 ppm.

Table 5-2
Surface Water Hazard Quotients - Chronic
Tennessee Products Site, Chattanooga, TN

Chemical	EPA Region 4 Freshwater Surface Water Chronic Screening Values (Organics-ug/L) (Inorganics-mg/L)	Hazard Quotient by Surface Water Sampling Location							
		WC-2	WC-3	WC-4	WC-5	WC-6	WC-7	WC-9	WC-8 Background
Organics									
Bis(2-ethylhexyl)phthalate	3.00E-01	ND	ND	ND	4.3E+01	ND	ND	ND	ND
Inorganics									
Aluminum	8.70E-02	5.6E+00	3.8E+00	3.7E+00	2.4E+00	2.1E+00	2.0E+00	2.2E+00	1.8E+00
Barium	NA	--	--	--	--	--	--	--	--
Copper	9.60E+00 a	4.3E-04	ND	ND	ND	ND	ND	ND	ND
Iron	1.00E+00	1.6E+00	4.3E-01	4.4E-01	3.4E-01	3.2E-01	3.1E-01	3.4E-01	2.9E-01
Manganese	NA	--	--	--	--	--	--	--	--
Strontium	NA	--	--	--	--	--	--	--	--
Titanium	NA	--	--	--	--	--	--	--	--
Zinc	8.60E+01 a	2.1E-04	4.8E-05	3.7E-05	3.0E-05	2.9E-05	3.5E-05	2.7E-05	3.0E-05

-- = Not applicable due to lack of criteria

NA = Criteria not available

ND = Not detected

^a Hardness dependent criteria, calculated using a hardness of 78 ppm.

(brook trout and striped bass). EPA is currently working on testing the chronic toxicity of aluminum under various conditions of pH and hardness, and plans on revising the chronic criteria based on the results of these tests (Delos, 1996). In the absence of an alternative chronic criteria for aluminum, the final chronic value of 748 ug/L can be used for comparison. Since none of the surface water concentrations exceed an aluminum concentration of 748 ug/L, aluminum is not expected to result in adverse effects to aquatic life in Chattanooga Creek.

5.2.2 Sediment

Potential risks to aquatic benthic and epibenthic life inhabiting the sediments of Chattanooga Creek were assessed by evaluating the results of the site-specific sediment toxicity tests and Microtox tests, and by comparing sediment concentrations to EPA Region 4 Sediment Effect Values, Ontario's Sediment Quality Guidelines, and EPA sediment criteria.

Comparison to Sediment Quality Guidelines/Criteria

Sediment concentrations at each sampling location in Chattanooga Creek were compared to EPA Region 4 Sediment Effect Values, supplemented with Ontario's Lowest Effect Levels (LELs) as presented in Table 5-3. The results show that where organics were detected in sediments (i.e., all locations), they exceeded the sediment effect values. The exceedances for PAHs, naphthalenes, and some pesticides were particularly high at certain locations, particularly DC-5U. Hazard quotients for organics ranged from 2 for phenanthrene at location DC-2 to 48,000 for acenaphthene at location DC-5U. It should be noted that concentrations of PAHs at the upgradient location (DC-8U) also exceed sediment effect values, and exceed concentrations of PAHs at locations DC-1, DC-2, DC-3U, and DC-9U, suggesting that the PAH concentrations in sediments may not be solely due to the Tennessee Products Site. Sampling locations DC-1

**Table 5-3
Sediment Hazard Quotients
Tennessee Products Site, Chattanooga, TN**

Chemical	Sediment Effect Values ^a (Organics-ug/kg) (Inorganics-mg/kg)	Source	Hazard Quotient by Sediment Sampling Location								
			DC-1	DC-2	DC-3U	DC-4U	DC-5U	DC-6U	DC-7U	DC-9U	DC-8U Background
Organics											
Acetone	NA	--	--	--	--	--	--	--	--	--	--
alpha - BHC	6.00E+00	OMOE	9.2E+01	ND	ND	1.5E+02	7.2E+02	3.2E+02	2.5E+01	4.7E+01	ND
beta-BHC	5.00E+00	OMOE	3.4E+01	7.6E+00	ND	1.9E+02	1.2E+02	R	2.6E+01	2.6E+01	ND
delta-BHC	NA	--	--	--	--	--	--	--	--	--	--
gamma-BHC	3.20E-01	EPA Reg. 4	4.1E+02	6.3E+01	ND	ND	ND	2.3E+03	ND	2.4E+02	ND
Carbazole	NA	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	NA	--	--	--	--	--	--	--	--	--	--
o-Chlorotoluene	NA	--	--	--	--	--	--	--	--	--	--
p-Chlorotoluene	NA	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	NA	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	NA	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	NA	--	--	--	--	--	--	--	--	--	--
Dieldrin	2.00E-02	EPA Reg. 4	3.8E+03	R	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	NA	--	--	--	--	--	--	--	--	--	--
Endosulfan II	NA	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	NA	--	--	--	--	--	--	--	--	--	--
Heptachlor epoxide	5.00E+00	OMOE	4.4E+00	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	2.00E+01	OMOE	2.3E+00	ND	ND	ND	ND	ND	ND	ND	ND
Methoxychlor	NA	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	2.02E+01	EPA Reg. 4	ND	ND	ND	7.4E+01	2.4E+04	3.3E+01	7.4E+01	ND	ND
(3- and/or 4-)Methylphenol	NA	--	--	--	--	--	--	--	--	--	--
Naphthalene	3.46E+01	EPA Reg. 4	2.7E+00	ND	ND	2.9E+02	4.0E+04	7.2E+01	1.3E+02	6.6E+01	ND
PAHs											
Acenaphthene	6.71E+00	EPA Reg. 4	ND	ND	ND	ND	4.8E+04	3.0E+02	3.9E+02	ND	ND
Acenaphthylene	5.87E+00	EPA Reg. 4	7.8E+01	2.0E+01	ND	ND	8.7E+03	2.6E+02	4.4E+02	9.9E+01	ND
Anthracene	4.69E+01	EPA Reg. 4	7.5E+00	ND	ND	5.8E+01	3.8E+03	1.1E+02	1.8E+02	2.3E+01	1.6E+01
Benzo(a)anthracene	7.48E+01	EPA Reg. 4	4.4E+01	1.2E+01	ND	1.1E+02	ND	ND	ND	ND	5.5E+01
Benzo(b and/or k) fluoranthene	2.40E+02	OMOE	3.8E+01	9.6E+00	5.0E+00	4.2E+01	1.6E+03	6.7E+01	1.0E+02	2.8E+01	2.3E+01
Benzo(g,h,i)perylene	1.70E+02	OMOE	1.3E+01	4.2E+00	8.2E+00	3.9E+01	1.4E+03	6.5E+01	9.4E+01	2.6E+01	2.1E+01
Benzo(a)pyrene	8.88E+01	EPA Reg. 4	4.7E+01	1.4E+01	ND	7.1E+01	2.8E+03	1.2E+02	1.8E+02	4.4E+01	3.9E+01
Chrysene	1.08E+02	EPA Reg. 4	3.5E+01	9.3E+00	1.0E+01	5.8E+01	ND	ND	ND	ND	4.0E+01
Dibenzo(a,h)anthracene	6.22E+00	EPA Reg. 4	1.3E+02	5.0E+01	ND	2.7E+02	1.0E+04	4.7E+02	7.1E+02	1.9E+02	1.4E+02
Fluoranthene	1.13E+02	EPA Reg. 4	2.7E+01	8.8E+00	1.7E+01	1.3E+02	5.9E+03	1.5E+02	1.9E+02	4.5E+01	8.7E+01
Fluorene	2.12E+01	EPA Reg. 4	ND	ND	ND	5.7E+01	1.9E+04	1.6E+02	1.8E+02	ND	ND
Indeno(1,2,3-cd)pyrene	2.00E+02	OMOE	1.5E+01	4.2E+00	6.5E+00	3.4E+01	1.3E+03	5.5E+01	9.0E+01	2.4E+01	1.8E+01

Table 5-3 (continued)
Sediment Hazard Quotients
Tennessee Products Site, Chattanooga, TN

Chemical	Sediment Effect Values ^a (Organics-ug/kg) (Inorganics-mg/kg)	Source	Hazard Quotient by Sediment Sampling Location								
			DC-1	DC-2	DC-3U	DC-4U	DC-5U	DC-6U	DC-7U	DC-9U	DC-8U Background
Phenanthrene	8.67E+01	EPA Reg. 4	6.5E+00	2.2E+00	ND	6.3E+01	1.7E+04	1.7E+02	2.0E+02	2.7E+01	5.2E+01
Pyrene	1.53E+02	EPA Reg. 4	2.2E+01	6.0E+00	1.1E+01	7.8E+01	3.3E+03	9.2E+01	1.2E+02	2.7E+01	4.9E+01
Toluene	NA	--	--	--	--	--	--	--	--	--	--
Xylene	NA	--	--	--	--	--	--	--	--	--	--
Inorganics											
Aluminum	NA	--	--	--	--	--	--	--	--	--	--
Arsenic	7.24E+00	EPA Reg. 4	6.9E-01	7.9E-01	8.0E-01	4.4E-01	6.5E-01	3.2E-01	ND	3.5E-01	4.0E-01
Barium	NA	--	--	--	--	--	--	--	--	--	--
Beryllium	NA	--	--	--	--	--	--	--	--	--	--
Cobalt	5.00E+01	OMOE	ND	3.0E-01	2.8E-01	2.2E-01	1.3E-01	9.8E-02	2.0E-01	1.2E-01	9.4E-02
Copper	1.87E+01	EPA Reg. 4	ND	ND	1.4E+00	6.4E-01	3.3E+00	1.7E+00	4.3E+00	1.0E+00	4.1E-01
Iron	2.00E+04	OMOE	8.0E-01	9.0E-01	1.0E+00	4.5E-01	5.0E-01	3.8E-01	6.0E-01	4.1E-01	3.2E-01
Lead	3.02E+01	EPA Reg. 4	7.9E-01	8.9E-01	2.0E+00	8.9E-01	1.3E+00	6.3E-01	1.7E+00	9.3E-01	8.9E-01
Magnesium	NA	--	--	--	--	--	--	--	--	--	--
Manganese	4.60E+02	OMOE	1.1E+00	2.8E+00	2.0E+00	9.8E-01	5.9E-01	5.0E-01	7.0E-01	3.9E-01	4.1E-01
Mercury	1.30E-01	EPA Reg. 4	1.0E+00	ND	9.2E-01	ND	2.7E+00	ND	ND	ND	ND
Molybdenum	NA	--	--	--	--	--	--	--	--	--	--
Nickel	1.59E+01	EPA Reg. 4	1.0E+00	9.4E-01	2.1E+00	9.4E-01	6.9E-01	5.1E-01	1.4E+00	7.5E-01	5.5E-01
Strontium	NA	--	--	--	--	--	--	--	--	--	--
Titanium	NA	--	--	--	--	--	--	--	--	--	--
Vanadium	NA	--	--	--	--	--	--	--	--	--	--
Yttrium	NA	--	--	--	--	--	--	--	--	--	--
Zinc	1.24E+02	EPA Reg. 4	5.0E-01	5.1E-01	1.5E+00	5.3E-01	6.0E-01	3.5E-01	1.2E+00	4.0E-01	3.7E-01

NA = Criteria not available

ND = Not Detected

R = Data rejected during data validation

-- = Not applicable due to lack of criteria

^a The sediment values reported for the Ontario Ministry of the Environment (OMOE) are Lowest Effect Levels.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 5
Revision: 0
Date: April 1996

and DC-2 had the lowest concentrations of organics. These two samples were taken in an unnamed tributary next to the Tar Dump (Figure 2-1).

The hazard quotients observed for metals were lower than those observed for organics, and ranged from slightly greater than one for manganese at location DC-1 to 4.3 for copper at location DC-7U. The metals that exceeded hazard quotients of one included copper, lead, manganese, mercury, nickel, and zinc. There were no exceedances of metal sediment screening values at locations DC-4U, DC-9U, and the upgradient location (DC-8U).

Sediment concentrations were also compared to EPA sediment quality criteria. EPA's criteria are normalized for the amount of total organic carbon (TOC) in the sediments. Since site-specific TOC is not available, the criteria were converted to a dry weight-normalized concentration based on a range of TOC values, and are presented in Table 5-4 for the COPCs. Location-specific hazard quotients were not calculated due to the number of iterations that would be necessary. Rather, the maximum detected concentration in sediments is presented for comparison purposes. The results show that there were no exceedances of the dieldrin criteria, but the PAH criteria are exceeded at all the organic carbon levels. Since the EPA criteria are less stringent than the EPA Region 4 effect levels, the exceedances are not quite as large as those observed based on comparison to the Region 4 values.

Sediment Toxicity Test

As discussed in Section 4.1.2, a *Ceriodaphnia dubia* (cladoceran) 7-day chronic test was conducted using whole sediment samples collected at all of the 9 sediment sampling locations in Chattanooga Creek, plus a laboratory control. The endpoints evaluated were survival and reproduction (average number of young). The test results are shown in Table 4-2, and indicate

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 5
Revision: 0
Date: April 1996

Table 5-4

**Comparison of Maximum Sediment Concentration to
U.S.EPA Sediment Quality Criteria**

Chemical	Maximum Sediment Concentration (mg/kg)	Sediment Quality Criteria (mg/kg) by % Total Organic Carbon					
		1%	2%	3%	4%	5%	10%
Dieldrin	0.076	0.11	0.22	0.33	0.44	0.55	1.1
Fluoranthene	670	6.2	12.4	18.6	24.8	31	62
Acenaphthene	320	1.3	2.6	3.9	5.2	6.5	13
Phenanthrene	1,500	1.8	3.6	5.4	7.2	9	18

Ecological Risk Assessment
Tennessee Products Site
Section: Section 5
Revision: 0
Date: April 1996

that adult survival and reproduction were significantly lower for sediment collected at sampling locations DC-1 and DC-5U. The toxicity of sediments collected at location DC-5U was particularly great, with 0% adult survival and reproduction. Sediment from DC-5U had the highest concentrations of PAHs and naphthalenes in sediments compared to other locations. It is also located downgradient of a sewer line, which if leaking, may be contributing ammonia or other compounds which may result in toxicity. However, this is only speculative since there is no information indicating that the sewer line is leaking. DC-1 had a number of exceedances of sediment effect levels for organics. However, the exceedances were similar to those calculated at other locations where toxicity was not observed. Although a large exceedance of the dieldrin EPA Region 4 Sediment Effect Value occurred at DC-1, the dieldrin concentrations fell below the EPA Sediment Quality Criteria at various TOC levels. Thus, it is not readily apparent what may be causing the toxicity at DC-1.

Microtox Tests

As discussed in Section 4.1.2, a Microtox test was run using sediment pore water. The test was run on pore water from sediments collected at 4 locations on Chattanooga Creek (DC-5U, DC-6U, DC-7U, and upgradient sample DC-8U), plus a control. The test results are shown in Table 4-2, and indicate that light inhibition is occurring in sediment sample DC-5U, since only 5.29% of the sample is needed to result in a 50% inhibition in light emissions. This is consistent with the *Daphnia* sediment toxicity tests which also showed the greatest toxicity at this location.

5.2.3 Aquatic Life Risk Summary

A summary of the risk results for aquatic life is presented in Table 5-5. The results indicate the potential for adverse effects to occur to aquatic life in Chattanooga Creek from exposure to

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 5
Revision: 0
Date: April 1996

Table 5-5

Summary of Risk to Aquatic Life

Aquatic Measurement Endpoint	Sampling Location								
	DC-1 WC-1	DC-2 WC-2	DC-3U WC-3	DC-4U WC-4	DC-5U WC-5	DC-6U WC-6	DC-7U WC-7	DC-9U WC-9	DC-8U WC-8 (bckg)
Exceedance of Surface Water Screening Values	✓	✓	✓	✓	✓	✓	✓	✓	✓
Exceedance of Sediment Screening Values	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sediment Toxicity to <i>Ceriodaphnia</i>	✓				✓				
Microtox Toxicity					✓				

Ecological Risk Assessment
Tennessee Products Site
Section: Section 5
Revision: 0
Date: April 1996

surface water and sediments. Chronic surface water screening values were exceeded for bis(2-ethylhexyl)phthalate (WC-5), aluminum (all locations), and iron (WC-2). The exceedance of the aluminum screening value is not of concern, since this value protects species which are not present in Chattanooga Creek (i.e., striped bass and brook trout). Exceedances of sediment guidelines/criteria occurred at all locations, including background location DC-8U, and were particularly high for PAHs, naphthalenes, and some pesticides. The sediment toxicity tests indicate the greatest toxicity occurring at location DC-5U, with significant toxic effects also occurring at location DC-1.

5.3 RISK CHARACTERIZATION FOR TERRESTRIAL WILDLIFE

5.3.1 Northern Short-Tailed Shrew

Potential risk to the short-tailed shrew was estimated by comparing the estimated daily doses for the chemicals of potential concern (Tables 3-8 and 3-9) with the reference toxicity values derived for the shrew (Table 4-6). The resulting hazard indices for the shrew are presented in Tables 5-6 and 5-7 for the Tar Dump and Hamill Road Dump No. 3, respectively. As shown in these tables, the following chemicals exceeded a hazard index of one, in order of greatest to least:

Table 5-6
Hazard Quotients and Indices
Northern Short-tailed Shrew
Tar Dump
Tennessee Products Site, Chattanooga, TN

Chemical	Hazard Quotient		Hazard Index
	Soil Ingestion Pathway *	Earthworm Ingestion Pathway *	
Organics			
Acetone	9.7E-03	NC	9.7E-03
Aldrin	5.4E-03	1.7E-01	1.8E-01
alpha - BHC	9.1E-03	8.9E-01	9.0E-01
beta-BHC	4.7E-02	4.6E+00	4.6E+00
delta-BHC	1.5E-03	1.5E-01	1.5E-01
gamma-BHC	1.3E-01	1.2E+01	1.2E+01
Carbazole	NTV	NC	NTV
alpha-Chlordane	5.4E-03	2.6E-01	2.6E-01
gamma-Chlordane	4.6E-03	2.2E-01	2.3E-01
DDD	1.0E-04	8.3E-03	8.4E-03
DDT	7.5E-04	7.7E-02	7.8E-02
Dibenzofuran	NTV	NC	NTV
Dieldrin	1.1E+00	1.1E+02	1.1E+02
Endosulfan I	3.9E-03	NC	3.9E-03
Endosulfan II	2.7E-03	NC	2.7E-03
Endrin	1.5E-02	5.1E-01	5.2E-01
Endrin aldehyde	NTV	NC	NTV
Heptachlor	5.8E-01	NC	5.8E-01
Heptachlor epoxide	2.8E-02	8.2E-01	8.5E-01
Hexachlorobenzene	7.0E-01	NC	7.0E-01
Methoxychlor	8.0E-04	2.2E-01	2.2E-01
2-Methylnaphthalene	NTV	NC	NTV
Naphthalene	1.1E-03	2.2E-03	3.3E-03
PAHs			
Acenaphthylene	1.2E-03	2.6E-03	3.9E-03
Anthracene	1.0E-03	3.1E-03	4.1E-03
Benzo(a)anthracene	1.1E-02	3.0E-02	4.1E-02
Benzo(a)pyrene	1.7E-02	5.5E-02	7.1E-02
Benzo(b and/or k)fluoranthene	2.6E-02	5.3E-02	7.9E-02
Benzo(g,h,i)perylene	6.6E-03	9.5E-03	1.6E-02
Chrysene	1.2E-02	5.0E-02	6.2E-02
Dibenzo(a,h)anthracene	4.8E-03	2.2E-02	2.7E-02
Fluoranthene	1.5E-02	5.4E-02	7.0E-02
Indeno(1,2,3-cd)pyrene	9.1E-03	3.6E-02	4.5E-02
Phenanthrene	2.9E-03	7.8E-03	1.1E-02
Pyrene	1.2E-02	4.5E-02	5.8E-02
Tetrachloroethene	3.5E-05	NC	3.5E-05
1,1,1-Trichloroethane	7.7E-07	NC	7.7E-07
Trichloroethylene	9.8E-07	NC	9.8E-07
Xylenes (total)	NTV	NC	NTV
Inorganics			
Aluminum	1.4E+01	4.5E+01	5.9E+01
Arsenic	1.5E-01	6.8E-02	2.2E-01
Barium	6.1E-02	2.1E-01	2.7E-01
Beryllium	7.5E-03	NC	7.5E-03
Cadmium	2.2E-02	9.6E-01	9.8E-01
Chromium (total)	1.2E-02	9.0E-02	1.0E-01
Cobalt	3.9E-01	NC	3.9E-01
Copper	1.1E-02	4.5E-02	5.6E-02
Iron	NTV	NTV	NTV
Lead	1.7E+00	8.9E+00	1.1E+01
Manganese	2.8E+00	3.0E+00	5.8E+00
Mercury	2.4E-03	8.5E-03	1.1E-02
Nickel	2.2E+01	3.8E+02	4.1E+02
Selenium	1.9E-01	NC	1.9E-01
Silver	2.0E-02	NC	2.0E-02
Vanadium	1.3E-01	NC	1.3E-01
Zinc	1.7E-01	1.6E+01	1.6E+01
Cyanide	3.2E-03	NC	3.2E-03

NC = Not calculated due to the lack of appropriate accumulation data.

NTV = No reference toxicity value available.

* Maximum soil exposure concentrations from 0 to 2 feet deep.

**Table 5-7
Hazard Quotients and Indices
Northern Short-tailed Shrew
Hamill Road Dump #3
Tennessee Products Site, Chattanooga, TN**

Chemical	Hazard Quotient		Hazard Index
	Soil Ingestion Pathway *	Earthworm Ingestion Pathway *	
Organics			
Aldrin	2.5E-03	8.0E-02	8.3E-02
beta-BHC	1.5E-02	1.4E+00	1.4E+00
delta-BHC	2.8E-04	2.7E-02	2.7E-02
gamma-BHC	3.2E-02	3.1E+00	3.2E+00
Carbazole	NTV	NC	NTV
alpha-Chlordane	2.8E-04	1.4E-02	1.4E-02
DDT	4.3E-03	4.4E-01	4.4E-01
Dibenzofuran	NTV	NC	NTV
Dieldrin	1.0E-01	9.5E+00	9.6E+00
Endosulfan I	7.7E-03	NC	7.7E-03
Endosulfan II	2.1E-03	NC	2.1E-03
Endosulfan sulfate	8.3E-04	NC	8.3E-04
Endrin	1.2E-02	4.3E-01	4.4E-01
Heptachlor	1.8E-01	NC	1.8E-01
Hexachlorobenzene	3.4E-02	NC	3.4E-02
2-Methylnaphthalene	NTV	NC	NTV
Naphthalene	8.0E-04	1.6E-03	2.4E-03
PAHs			
Acenaphthylene	1.2E-03	2.5E-03	3.7E-03
Anthracene	1.2E-03	3.6E-03	4.8E-03
Benzo(a)anthracene	1.5E-02	3.9E-02	5.4E-02
Benzo(a)pyrene	1.4E-02	4.6E-02	6.1E-02
Benzo(b and/or k)fluoranthene	3.3E-02	6.8E-02	1.0E-01
Benzo(g,h,i)perylene	3.0E-03	4.3E-03	7.3E-03
Chrysene	1.7E-02	7.3E-02	9.0E-02
Dibenzo(a,h)anthracene	3.7E-03	1.8E-02	2.1E-02
Fluoranthene	2.9E-02	1.0E-01	1.3E-01
Indeno(1,2,3-cd)pyrene	9.7E-03	3.8E-02	4.8E-02
Phenanthrene	4.2E-03	1.1E-02	1.6E-02
Pyrene	2.8E-02	1.0E-01	1.3E-01
Styrene	3.1E-05	NC	3.1E-05
1,1,1-Trichloroethane	1.8E-06	NC	1.8E-06
Xylenes (total)	NTV	NC	NTV
Inorganics			
Aluminum	1.8E+01	6.1E+01	7.9E+01
Arsenic	1.6E-01	7.2E-02	2.3E-01
Barium	6.5E-02	2.3E-01	2.9E-01
Beryllium	7.7E-03	NC	7.7E-03
Chromium (total)	3.2E-03	2.4E-02	2.7E-02
Cobalt	3.5E-01	NC	3.5E-01
Copper	1.1E-02	4.5E-02	5.6E-02
Iron	NTV	NTV	NTV
Lead	9.8E-01	5.0E+00	6.0E+00
Manganese	6.9E+00	7.3E+00	1.4E+01
Mercury	6.8E-04	2.4E-03	3.1E-03
Nickel	1.7E+01	2.9E+02	3.0E+02
Selenium	5.4E-01	NC	5.4E-01
Vanadium	1.5E-01	NC	1.5E-01
Zinc	9.0E-02	8.6E+00	8.7E+00
Cyanide	5.6E-03	NC	5.6E-03

NC = Not calculated due to the lack of appropriate accumulation data.

NTV = No reference toxicity value available.

* Maximum soil exposure concentrations from 0 to 2 feet deep.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 5
Revision: 0
Date: April 1996

Tar Dump	Hamill Road Dump #3
<ul style="list-style-type: none">• Nickel (410)• Dieldrin (110)• Aluminum (59)• Zinc (16)• gamma-BHC (12)• Lead (11)• Manganese (5.8)• beta-BHC (4.6)	<ul style="list-style-type: none">• Nickel (310)• Aluminum (79)• Manganese (14)• Dieldrin (9.6)• Zinc (8.7)• Lead (6.0)• gamma-BHC (3.2)• beta-BHC (1.5)

Nickel had the highest hazard quotient for both the Tar Dump and Hamill Road Dump No. 3. For nickel, 95 % of the risk was contributed by the earthworm ingestion route. For the other inorganics which exceeded a hazard quotient of one, the majority of risk (77-99 %) was contributed by the earthworm ingestion pathway, with the exception of manganese which had equal contribution from both exposure routes. For the organics which exceeded a hazard quotient of one, approximately 99 % of the risk was contributed by the earthworm ingestion route. The results show a potential for adverse effects to occur to omnivorous small mammals that feed at the site.

5.3.2 White-Footed Mouse

Potential risk to the white-footed mouse was estimated by comparing the estimated daily doses for the chemicals of potential concern (Tables 3-11 and 3-12) with the reference toxicity values derived for the mouse (Table 4-6). The resulting hazard indices for the white-footed mouse are presented in Tables 5-8 and 5-9 for the Tar Dump and Hamill Road Dump No. 3, respectively.

**Table 5-8
Hazard Quotients and Indices
White-footed Mouse
Tar Dump
Tennessee Products Site, Chattanooga, TN**

Chemical	Hazard Quotient		Hazard Index
	Soil Ingestion Pathway ^a	Seed Ingestion Pathway ^b	
Organics			
Acetone	2.0E-03	5.2E+00	5.2E+00
Aldrin	ND	3.8E-02	3.8E-02
alpha - BHC	1.3E-03	2.0E-02	2.1E-02
beta-BHC	3.5E-03	1.0E-01	1.1E-01
delta-BHC	1.6E-04	2.5E-03	2.7E-03
gamma-BHC	1.7E-02	2.7E-01	2.9E-01
Carbazole	NTV	NTV	NTV
alpha-Chlordane	ND	5.2E-02	5.2E-02
gamma-Chlordane	2.1E-03	4.5E-02	4.7E-02
DDD	ND	1.4E-05	1.4E-05
DDT	ND	4.4E-04	4.4E-04
Dibenzofuran	ND	NTV	NTV
Dieldrin	2.3E-01	4.0E+00	4.2E+00
Endosulfan I	7.8E-04	1.3E-02	1.4E-02
Endosulfan II	8.6E-04	8.6E-03	9.5E-03
Endrin	ND	3.3E-03	3.3E-03
Endrin aldehyde	NTV	NTV	NTV
Heptachlor	1.2E-01	6.5E-01	7.7E-01
Heptachlor epoxide	6.9E-03	3.1E-01	3.1E-01
Hexachlorobenzene	9.5E-02	1.8E-01	2.8E-01
Methoxychlor	ND	1.0E-03	1.0E-03
2-Methylnaphthalene	NTV	NTV	NTV
Naphthalene	1.8E-04	4.8E-03	5.0E-03
PAHs			
Acenaphthylene	3.2E-04	3.4E-03	3.8E-03
Anthracene	2.6E-04	9.4E-04	1.2E-03
Benzo(a)anthracene	1.7E-03	2.6E-03	4.3E-03
Benzo(a)pyrene	2.1E-03	1.6E-03	3.7E-03
Benzo(b and/or k)fluoranthene	4.7E-03	3.2E-03	7.9E-03
Benzo(g,h,i)perylene	9.6E-04	4.4E-04	1.4E-03
Chrysene	1.8E-03	2.6E-03	4.5E-03
Dibenzo(a,h)anthracene	8.1E-04	1.1E-03	1.9E-03
Fluoranthene	2.0E-03	5.9E-03	7.8E-03
Indeno(1,2,3-cd)pyrene	1.8E-03	6.2E-04	2.4E-03
Phenanthrene	3.6E-04	2.8E-03	3.1E-03
Pyrene	1.9E-03	4.8E-03	6.7E-03
Tetrachloroethene	7.1E-06	4.7E-04	4.8E-04
1,1,1-Trichloroethane	5.9E-08	1.1E-05	1.1E-05
Trichloroethylene	1.3E-07	1.5E-05	1.5E-05
Xylenes (total)	ND	NTV	NTV
Inorganics			
Aluminum	3.4E+00	9.0E-02	3.5E+00
Arsenic	2.7E-02	8.9E-03	3.6E-02
Barium	1.4E-02	9.2E-03	2.3E-02
Beryllium	ND	1.1E-04	1.1E-04
Cadmium	ND	3.3E-02	3.3E-02
Chromium (total)	2.3E-03	5.5E-04	2.8E-03
Cobalt	6.5E-02	2.7E-02	9.2E-02
Copper	2.3E-03	2.7E-02	2.9E-02
Iron	NTV	NTV	NTV
Lead	5.5E-01	1.6E-01	7.1E-01
Manganese	5.8E-01	1.4E+00	2.0E+00
Mercury	4.9E-04	4.9E-03	5.4E-03
Nickel	3.7E+00	1.3E+01	1.7E+01
Selenium	ND	4.7E-02	4.7E-02
Silver	1.2E-02	2.0E-02	3.2E-02
Vanadium	2.9E-02	3.9E-03	3.2E-02
Zinc	4.1E-02	1.5E+00	1.6E+00
Cyanide	ND	4.3E-02	4.3E-02

ND = Not detected in associated medium.

NTV = No reference toxicity value available.

^a Maximum soil exposure concentrations from 0 to 0.5 foot deep.

^b Maximum soil exposure concentrations from 0 to 2 feet deep.

**Table 5-9
Hazard Quotients and Indices
White-footed Mouse
Hamill Road Dump #3
Tennessee Products Site, Chattanooga, TN**

Chemical	Hazard Quotient		Hazard Index
	Soil Ingestion Pathway ^a	Seed Ingestion Pathway ^b	
<i>Organics</i>			
Aldrin	5.1E-04	1.8E-02	1.8E-02
beta-BHC	3.0E-03	3.2E-02	3.5E-02
delta-BHC	5.6E-05	4.6E-04	5.2E-04
gamma-BHC	6.5E-03	7.0E-02	7.7E-02
Carbazole	NTV	NTV	NTV
alpha-Chlordane	ND	2.7E-03	2.7E-03
DDT	8.6E-04	2.5E-03	3.3E-03
Dibenzofuran	NTV	NTV	NTV
Dieldrin	2.0E-02	3.5E-01	3.7E-01
Endosulfan I	1.6E-03	2.7E-02	2.8E-02
Endosulfan II	4.2E-04	6.6E-03	7.0E-03
Endosulfan sulfate	1.7E-04	1.8E-03	2.0E-03
Endrin	2.5E-03	2.8E-03	5.3E-03
Heptachlor	3.6E-02	2.0E-01	2.3E-01
Hexachlorobenzene	2.2E-02	8.8E-03	3.0E-02
2-Methylnaphthalene	NTV	NTV	NTV
Naphthalene	8.6E-05	3.6E-03	3.7E-03
<i>PAHs</i>			
Acenaphthylene	5.1E-05	3.3E-03	3.3E-03
Anthracene	3.8E-04	1.1E-03	1.5E-03
Benzo(a)anthracene	3.0E-03	3.3E-03	6.3E-03
Benzo(a)pyrene	2.9E-03	1.3E-03	4.2E-03
Benzo(b and/or k)fluoranthene	6.8E-03	4.1E-03	1.1E-02
Benzo(g,h,i)perylene	1.7E-04	2.0E-04	3.7E-04
Chrysene	3.5E-03	3.8E-03	7.3E-03
Dibenzo(a,h)anthracene	7.5E-04	8.4E-04	1.6E-03
Fluoranthene	5.9E-03	1.1E-02	1.7E-02
Indeno(1,2,3-cd)pyrene	2.0E-03	6.5E-04	2.6E-03
Phenanthrene	8.6E-04	4.0E-03	4.9E-03
Pyrene	5.6E-03	1.1E-02	1.6E-02
Styrene	1.9E-06	1.8E-04	1.9E-04
1,1,1-Trichloroethane	6.8E-07	2.7E-05	2.8E-05
Xylenes (total)	ND	NTV	NTV
<i>Inorganics</i>			
Aluminum	3.1E+00	1.2E-01	3.3E+00
Arsenic	3.4E-02	9.5E-03	4.4E-02
Barium	1.3E-02	9.9E-03	2.3E-02
Beryllium	ND	1.2E-04	1.2E-04
Chromium (total)	1.1E-03	1.4E-04	1.2E-03
Cobalt	6.6E-02	2.5E-02	9.1E-02
Copper	4.0E-03	2.7E-02	3.1E-02
Iron	NTV	NTV	NTV
Lead	3.1E-01	8.9E-02	4.0E-01
Manganese	9.1E-01	3.5E+00	4.4E+00
Mercury	2.0E-04	1.4E-03	1.6E-03
Nickel	3.5E+00	1.0E+01	1.4E+01
Selenium	1.1E-01	1.4E-01	2.5E-01
Vanadium	3.0E-02	4.6E-03	3.4E-02
Zinc	2.7E-02	8.2E-01	8.5E-01
Cyanide	2.3E-03	7.7E-02	7.9E-02

ND = Not detected in associated medium.

NTV = No reference toxicity value available.

^a Maximum soil exposure concentrations from 0 to 0.5 foot deep.

^b Maximum soil exposure concentrations from 0 to 2 feet deep.

As shown in these tables, the following chemicals exceeded a hazard index of one, in order of greatest to least:

Tar Dump	Hamill Road Dump #3
<ul style="list-style-type: none">● Nickel (17)● Acetone (5.2)● Dieldrin (4.2)● Aluminum (3.5)● Manganese (2.0)● Zinc (1.6)	<ul style="list-style-type: none">● Nickel (14)● Manganese (4.4)● Aluminum (3.3)

Nickel had the highest hazard quotient for both the Tar Dump and Hamill Road Dump No. 3, but were much lower than those calculated for the short-tailed shrew. For nickel, 74-78% of the risk was contributed by the seed ingestion route. For the organics, manganese, and zinc, the majority of risk (71-99.9%) was contributed by the seed ingestion pathway. For aluminum the majority of the risk (96-97%) was contributed by the soil ingestion route. Since most of the hazard quotients fall below 10, or are very close to 10, there is most likely limited potential for adverse effects to occur to herbivorous small mammals that feed at the site.

5.3.3 American Robin

Potential risk to the robin was estimated by comparing the estimated daily doses for the chemicals of potential concern (Tables 3-14 and 3-15) with the reference toxicity values derived for the robin (Table 4-7). The resulting hazard indices for the robin are presented in Table 5-10 and 5-11, for the Tar Dump and Hamill Road Dump No. 3, respectively. The hazard indices presented for acetone, gamma-BHC, chlordane, DDD, dieldrin, endosulfan, heptachlor, methoxychlor, naphthalene, xylene, manganese, nickel, and cyanide are based on acute

Table 5-10
Hazard Quotients and Indices
American Robin
Tar Dump
Tennessee Products Site, Chattanooga, TN

Chemical	Hazard Quotient		Hazard Index
	Soil Ingestion Pathway ^a	Earthworm Ingestion Pathway ^b	
Organics			
Acetone	7.1E-04	NC	7.1E-04
Aldrin	ND	9.6E-03	9.6E-03
alpha - BHC	NTV	NTV	NTV
beta-BHC	NTV	NTV	NTV
delta-BHC	NTV	NTV	NTV
gamma-BHC	2.6E-03	3.7E-01	3.8E-01
Carbazole	NTV	NC	NTV
alpha-Chlordane	ND	1.8E-02	1.8E-02
gamma-Chlordane	7.4E-04	1.5E-02	1.6E-02
DDD	ND	1.8E-02	1.8E-02
DDT	ND	4.6E-01	4.6E-01
Dibenzofuran	ND	NC	NTV
Dieldrin	3.6E-01	3.3E+01	3.4E+01
Endosulfan I	2.9E-04	NC	2.9E-04
Endosulfan II	3.2E-04	NC	3.2E-04
Endrin	ND	1.2E+00	1.2E+00
Endrin aldehyde	NTV	NC	NTV
Heptachlor	1.7E+00	NC	1.7E+00
Heptachlor epoxide	NTV	NTV	NTV
Hexachlorobenzene	4.3E-01	NC	4.3E-01
Methoxychlor	ND	3.6E-03	3.6E-03
2-Methylnaphthalene	NTV	NC	NTV
Naphthalene	1.2E-04	2.9E-04	4.1E-04
PAHs			
Acenaphthylene	NTV	NTV	NTV
Anthracene	NTV	NTV	NTV
Benzo(a)anthracene	NTV	NTV	NTV
Benzo(a)pyrene	NTV	NTV	NTV
Benzo(b and/or k)fluoranthene	NTV	NTV	NTV
Benzo(g,h,i)perylene	NTV	NTV	NTV
Chrysene	NTV	NTV	NTV
Dibenzo(a,h)anthracene	NTV	NTV	NTV
Fluoranthene	NTV	NTV	NTV
Indeno(1,2,3-cd)pyrene	NTV	NTV	NTV
Phenanthrene	NTV	NTV	NTV
Pyrene	NTV	NTV	NTV
Tetrachloroethene	NTV	NC	NTV
1,1,1-Trichloroethane	NTV	NC	NTV
Trichloroethylene	NTV	NC	NTV
Xylenes (total)	ND	NC	NC
Inorganics			
Aluminum	5.9E+01	1.5E+02	2.1E+02
Arsenic	3.3E-02	1.6E-02	4.9E-02
Barium	NTV	NTV	NTV
Beryllium	ND	NC	NTV
Cadmium	ND	4.4E-01	4.4E-01
Chromium (total)	2.0E-01	1.5E+00	1.7E+00
Cobalt	NTV	NC	NTV
Copper	6.2E-02	2.4E-01	3.0E-01
Iron	NTV	NTV	NTV
Lead	5.5E-01	1.8E+00	2.3E+00
Manganese	4.0E-01	4.0E-01	8.0E-01
Mercury	4.8E-01	1.7E+00	2.1E+00
Nickel	1.7E-01	3.5E+00	3.7E+00
Selenium	ND	NC	NC
Silver	8.2E-02	NC	8.2E-02
Vanadium	4.1E+00	NC	4.1E+00
Zinc	9.0E-02	7.1E+00	7.2E+00
Cyanide	ND	NC	NC

NC = Not calculated due to the lack of appropriate accumulation data.

ND = Not detected in associated medium.

NTV = No reference toxicity value available.

^a Maximum soil exposure concentrations from 0 to 0.5 foot deep.

^b Maximum soil exposure concentrations from 0 to 2 feet deep.

Table 5-11
Hazard Quotients and Indices
American Robin
Hamill Road Dump #3
Tennessee Products Site, Chattanooga, TN

Chemical	Hazard Quotient		Hazard Index
	Soil Ingestion Pathway ^a	Earthworm Ingestion Pathway ^b	
<i>Organics</i>			
Aldrin	1.4E-04	4.5E-03	4.6E-03
beta-BHC	NTV	NTV	NTV
delta-BHC	NTV	NTV	NTV
gamma-BHC	1.0E-03	9.6E-02	9.7E-02
Carbazole	NTV	NC	NTV
alpha-Chlordane	ND	9.4E-04	9.4E-04
DDT	2.6E-02	2.6E+00	2.6E+00
Dibenzofuran	NTV	NC	NTV
Dieldrin	3.1E-02	2.9E+00	2.9E+00
Endosulfan I	5.9E-04	NC	5.9E-04
Endosulfan II	1.6E-04	NC	1.6E-04
Endosulfan sulfate	NTV	NC	NTV
Endrin	2.9E-02	1.0E+00	1.0E+00
Heptachlor	5.3E-01	NC	5.3E-01
Hexachlorobenzene	9.8E-02	NC	9.8E-02
2-Methylnaphthalene	NTV	NC	NTV
Naphthalene	5.8E-05	2.2E-04	2.7E-04
<i>PAHs</i>			
Acenaphthylene	NTV	NTV	NTV
Anthracene	NTV	NTV	NTV
Benzo(a)anthracene	NTV	NTV	NTV
Benzo(a)pyrene	NTV	NTV	NTV
Benzo(b and/or k)fluoranthene	NTV	NTV	NTV
Benzo(g,h,i)perylene	NTV	NTV	NTV
Chrysene	NTV	NTV	NTV
Dibenzo(a,h)anthracene	NTV	NTV	NTV
Fluoranthene	NTV	NTV	NTV
Indeno(1,2,3-cd)pyrene	NTV	NTV	NTV
Phenanthrene	NTV	NTV	NTV
Pyrene	NTV	NTV	NTV
Styrene	NTV	NC	NTV
1,1,1-Trichloroethane	NTV	NC	NTV
Xylenes (total)	ND	NC	NC
<i>Inorganics</i>			
Aluminum	5.5E+01	2.1E+02	2.6E+02
Arsenic	4.2E-02	1.7E-02	5.9E-02
Barium	NTV	NTV	NTV
Beryllium	ND	NC	NTV
Chromium (total)	9.3E-02	4.0E-01	5.0E-01
Cobalt	NTV	NC	NTV
Copper	1.1E-01	2.4E-01	3.5E-01
Iron	NTV	NTV	NTV
Lead	3.1E-01	9.9E-01	1.3E+00
Manganese	6.2E-01	9.9E-01	1.6E+00
Mercury	2.0E-01	4.6E-01	6.7E-01
Nickel	1.6E-01	2.6E+00	2.8E+00
Selenium	4.7E-01	NC	4.7E-01
Vanadium	4.2E+00	NC	4.2E+00
Zinc	6.1E-02	3.8E+00	3.8E+00
Cyanide	7.8E-02	NC	7.8E-02

NC = Not calculated due to the lack of appropriate accumulation data.

ND = Not detected in associated medium.

NTV = No reference toxicity value available.

^a Maximum soil exposure concentrations from 0 to 0.5 foot deep.

^b Maximum soil exposure concentrations from 0 to 2 feet deep.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 5
Revision: 0
Date: April 1996

endpoints, since only acute toxicity data were available for deriving the RTVs. The hazard indices for all other chemicals are based on chronic endpoints. As shown in Tables 5-10 and 5-11, the following chemicals exceeded a hazard index of one, in order of greatest to least:

Tar Dump	Hamill Road Dump #3
<ul style="list-style-type: none">● Aluminum (210)● Dieldrin (34)● Zinc (7.2)● Vanadium (4.1)● Nickel (3.7)● Lead (2.3)● Mercury (2.2)● Heptachlor (1.7)● Chromium (1.7)● Endrin (1.2)	<ul style="list-style-type: none">● Aluminum (260)● Vanadium (4.3)● Zinc (3.8)● Dieldrin (3.0)● Nickel (2.8)● DDT (2.7)● Manganese (1.6)● Lead (1.3)

Aluminum had the highest hazard indices for both the Tar Dump and Hamill Road Dump No. 3. The majority (72%-100%) of the hazard index for aluminum, as well as DDT, dieldrin, endrin, chromium, lead, mercury, nickel, and zinc, can be attributed to earthworm ingestion. The hazard indices for vanadium and heptachlor were based solely on soil ingestion. The results show a potential for adverse effects to occur to omnivorous song birds that feed at the site.

5.3.4 Muskrat

Potential risk to the muskrat was estimated by comparing the estimated daily doses for the chemicals of potential concern (Table 3-17) with the reference toxicity values derived for the

Ecological Risk Assessment
Tennessee Products Site
Section: Section 5
Revision: 0
Date: April 1996

muskrat (Table 4-6). The resulting hazard indices for the muskrat are presented in Table 5-12. As shown in Table 5-12, the following chemicals exceeded a hazard index of one, in order of greatest to least:

- Titanium (13)
- Nickel (8.2)
- Selenium (5.2)
- Aluminum (3.4)
- Manganese (1.4)

For these chemical, 99-100% of the risk can be attributed to clam ingestion. Very little risk was observed for the surface water ingestion route. The background concentrations for all of these metals (see Table 2-7), with the exception of selenium, exceed all of the concentrations detected in downstream locations, suggesting that these metals are at natural levels in clam tissue. These chemicals were not eliminated as chemicals of concern, since one background sample was not considered sufficient for this purpose. However, it appears that metal concentrations in clam tissue in downgradient areas are at background levels. Since the hazard indices fall below 10, or are very close to 10, and since they are at background levels, there does not appear to be a potential for adverse effects to occur to the muskrat feeding on clams in Chattanooga Creek.

5.4 RISK CHARACTERIZATION FOR TERRESTRIAL VEGETATION

Potential effects to terrestrial plants at the site was assessed by comparing maximum soil concentrations from the 0-2 foot depth to available phytotoxicity data. These comparisons are provided in Tables 5-13 and 5-14 for the Tar Dump and Hamill Road Dump No. 3, respectively. Phytotoxicity data was available for a limited amount of organic chemicals. A much greater amount of phytotoxicity data were available for the inorganics. Exceedances of phytotoxicity data in Tar Dump soils occurred for gamma-BHC, dieldrin, aluminum, arsenic, chromium, lead,

Table 5-12
Hazard Quotients and Indices
Muskrat
Chattanooga Creek
Tennessee Products Site, Chattanooga, TN

Chemical	Hazard Quotient		Hazard Index
	Clam Ingestion Pathway	Surface Water Ingestion Pathway	
Organics			
Bis(2-ethylhexyl)phthalate	ND	6.2E-05	6.2E-05
PAHs			
Benzo(a)anthracene	2.1E-06	ND	2.1E-06
Chrysene	2.1E-06	ND	2.1E-06
Fluoranthene	3.5E-06	ND	3.5E-06
Inorganics			
Aluminum	3.4E+00	2.3E-03	3.4E+00
Arsenic	3.6E-01	ND	3.6E-01
Barium	2.0E-02	7.7E-05	2.0E-02
Cobalt	1.1E-01	ND	1.1E-01
Copper	8.1E-02	7.5E-06	8.1E-02
Iron	NTV	NTV	NTV
Manganese	1.3E+00	4.6E-03	1.4E+00
Mercury	1.1E-03	ND	1.1E-03
Nickel	8.2E+00	ND	8.2E+00
Selenium	5.2E+00	ND	5.2E+00
Strontium	6.8E-03	1.4E-04	7.0E-03
Titanium	1.3E+01	3.4E-02	1.3E+01
Vanadium	2.3E-02	ND	2.3E-02
Zinc	5.3E-01	4.7E-05	5.3E-01

ND = Not detected in associated medium.

NTV = No reference toxicity value available.

Table 5-13
Comparison of Available Plant Toxicity Values to Tar Dump Maximum Soil Concentrations (0 to 2 feet deep)
Tennessee Products Site - Chattanooga, TN

Chemical	Maximum Soil Concentration (mg/kg)	Medium or Soil Type	Plant Species	No Observed Effect Concentration ^a (mg/kg)	Lowest Observed Effect Concentration ^b (mg/kg)	Effect	Reference
Organics							
Aldrin	2.80E-03	sandy loam	Bengal gram	---	1.00E+00	reduced nodulation	Kapoor et al., 1977
		sandy loam	Bengal gram	---	1.00E+01	reduced N fixation	Kapoor et al., 1977
		soil	corn	---	3.70E-01	10% decrease in size	Phytotox Database, 1996
beta-BHC	1.30E+00	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
gamma-BHC	1.10E+00	alluvial soil	groundnut	---	1.00E+00	reduced root nodulation	Misra and Gaur, 1974
		sand	pea plant	---	2.00E+00	reduced root length	Charnetski et al., 1973
		sand	pea plant	---	4.00E+00	no secondary roots	Charnetski et al., 1973
		sand	pea plant	---	8.00E+00	root cells vacuolated	Charnetski et al., 1973
		alluvial soil	groundnut	---	1.00E+01	no root nodulation	Misra and Gaur, 1974
		sand	pea plant	---	3.00E+01	no cellular organization	Charnetski et al., 1973
		alluvial soil	groundnut	---	1.00E+02	decrease in pod yield	Misra and Gaur, 1974
alpha-Chlordane	3.60E-02	soil	turfgrass	---	3.25E+01	95% reduction in germin.	Phytotox Database, 1996
gamma-Chlordane	9.00E-02	soil	turfgrass	---	3.25E+01	95% reduction in germin.	Phytotox Database, 1996
DDT	7.80E-03	soil	bean	3.85E+01	---	no injury to shoots	Phytotox Database, 1996
Dieldrin	3.90E+00	soil	corn	---	1.15E+00	plant size	Phytotox Database, 1996
Endosulfan I	1.00E-01	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
Endosulfan II	1.20E-01	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
Heptachlor	3.00E-01	soil	cotton	---	1.56E+04	decrease in plant yield	Phytotox Database, 1996
Naphthalene	4.60E-01	agricultural loam	lettuce	---	1.00E+02	50% reduction in growth	Hulzebos et al., 1993
Tetrachloroethene	4.00E-03	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
1,1,1-Trichloroethane	8.00E-03	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
Xylenes (total)	1.00E-03	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
Inorganics							
Aluminum	1.40E+04	silt loam	white clover	---	5.00E+01	seedling establish	Will and Suter, 1994
Arsenic	1.40E+01	sandy loam	cotton	---	1.12E+01	shoot weight	Will and Suter, 1994
		sandy loam	soybean	---	1.12E+01	shoot weight	Will and Suter, 1994
		black clay	soybean	---	2.24E+01	shoot weight	Will and Suter, 1994
		black clay	cotton	6.72E+01	8.96E+01	shoot weight	Will and Suter, 1994
		---	spruce	---	1.00E+03	height	Will and Suter, 1994
Barium	1.50E+02	loam	barley	---	5.00E+02	plant weight	Will and Suter, 1994
		loam	bush beans	1.00E+03	2.00E+03	plant weight	Will and Suter, 1994
Beryllium	1.40E+00	surface soil	---	---	1.00E+01	phytotoxic	Will and Suter, 1994
Cadmium ^c	3.70E-01	soil+sand	spruce	1.00E+00	2.00E+00	root & shoot weight	Will and Suter, 1994
		sand +peat	soybean	1.25E+00	2.50E+00	plant weight	Will and Suter, 1994
		silt loam	soybean	1.00E+00	1.00E+01	shoot weight	Will and Suter, 1994
		sand +peat	soybean	5.00E+00	1.00E+01	plant weight	Will and Suter, 1994
		sandy loam	red oak	1.00E+01	2.00E+01	plant weight	Will and Suter, 1994
		sand	Kentucky bluegrass	1.00E+01	3.00E+01	root & shoot weight	Will and Suter, 1994

Table 5-13 (continued)
Comparison of Available Plant Toxicity Values to Tar Dump Maximum Soil Concentrations (0 to 2 feet deep)
Tennessee Products Site - Chattanooga, TN

Chemical	Maximum Soil Concentration (mg/kg)	Medium or Soil Type	Plant Species	No Observed Effect Concentration ^a (mg/kg)	Lowest Observed Effect Concentration ^b (mg/kg)	Effect	Reference
Cadmium - (continued)	3.70E-01	alluvial	wheat	1.00E+01	3.00E+01	grain yield	Will and Suter, 1994
		humic sand	oats	1.00E+01	9.70E+01	fresh shoot weight	Will and Suter, 1994
		silt loam	rye	5.00E+01	1.00E+02	shoot weight	Will and Suter, 1994
		alluvial	rice	3.00E+01	1.00E+02	root & shoot weight	Will and Suter, 1994
		silt loam	soybean	1.00E+01	1.00E+02	shoot weight	Will and Suter, 1994
		loam	oats	1.00E+01	1.59E+02	leaf weight	Will and Suter, 1994
Chromium	3.60E+02	loam	oats	3.50E+00	7.40E+00	fresh shoot weight	Will and Suter, 1994
		loam	soybean	1.00E+01	3.00E+01	fresh shoot weight	Will and Suter, 1994
		humic sand	oats	1.10E+01	3.10E+01	fresh shoot weight	Will and Suter, 1994
Cobalt	2.40E+01	surface soil	---	---	2.50E+01	phytotoxic	Will and Suter, 1994
Copper	5.90E+01	sand	blue stem	---	1.00E+02	root & shoot weight	Will and Suter, 1994
		sand	blue stem	---	1.00E+02	root & shoot weight	Will and Suter, 1994
		loam	bush beans	1.00E+02	2.00E+02	leaf weight	Will and Suter, 1994
Lead	1.30E+02	silty clay loam	sycamore	---	5.00E+01	leaf weight	Will and Suter, 1994
		sandy loam	red oak	2.00E+01	5.00E+01	plant weight	Will and Suter, 1994
		soil+sand	spruce	5.00E+01	1.00E+02	root & shoot weight	Will and Suter, 1994
		soil:sand:peat	autumn olive	8.00E+01	1.60E+02	transpiration	Will and Suter, 1994
		sand	blue stem	---	4.50E+02	root & shoot weight	Will and Suter, 1994
		sand	blue stem	---	4.50E+02	root weight	Will and Suter, 1994
		brown earth	oats	1.00E+02	5.00E+02	root weight	Will and Suter, 1994
		brown earth	wheat	5.00E+02	1.00E+03	root weight	Will and Suter, 1994
		alluvial	wheat	3.00E+02	1.00E+03	root & shoot weight	Will and Suter, 1994
		silt loam	rye	1.00E+03	5.00E+03	shoot weight	Will and Suter, 1994
		silt loam	fescue	1.00E+03	5.00E+03	shoot weight	Will and Suter, 1994
Manganese	1.20E+03	loam	bush beans	---	5.00E+02	stem weight	Will and Suter, 1994
Mercury	7.90E-01	surface soil	---	---	3.00E-01	---	Will and Suter, 1994
Nickel	4.10E+01	loam	barley	---	2.50E+01	shoot weight	Will and Suter, 1994
		sandy loam	red oak	2.00E+01	5.00E+01	plant weight	Will and Suter, 1994
		loam	bush beans	2.50E+01	1.00E+02	leaf weight	Will and Suter, 1994
		loam	bush beans	---	1.00E+02	shoot weight	Will and Suter, 1994
		loam	cotton	---	1.00E+02	leaf & stem weights	Will and Suter, 1994
		loam	ryegrass	9.00E+01	1.80E+02	shoot weight	Will and Suter, 1994
		loam	bush beans	1.00E+02	2.50E+02	shoot weight	Will and Suter, 1994

Table 5-13 (continued)
Comparison of Available Plant Toxicity Values to Tar Dump Maximum Soil Concentrations (0 to 2 feet deep)
Tennessee Products Site - Chattanooga, TN

Chemical	Maximum Soil Concentration (mg/kg)	Medium or Soil Type	Plant Species	No Observed Effect Concentration ^a (mg/kg)	Lowest Observed Effect Concentration ^b (mg/kg)	Effect	Reference
Selenium	1.60E+00	loamy sand	sorghass	---	1.00E+00	shoot weight	Will and Suter, 1994
		sand	sorghass	---	1.00E+00	shoot weight	Will and Suter, 1994
		loamy sand	sorghass	---	1.00E+00	shoot weight	Will and Suter, 1994
		sand	sorghass	---	1.00E+00	shoot weight	Will and Suter, 1994
		sandy loam	alfalfa	5.00E-01	1.50E+00	shoot weight	Will and Suter, 1994
		clay loam	alfalfa	5.00E-01	1.50E+00	shoot weight	Will and Suter, 1994
		clay loam	alfalfa	5.00E-01	1.50E+00	shoot weight	Will and Suter, 1994
		sand	sorghass	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
		silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
		silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
		silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
		silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
		silty clay loam	alfalfa	2.00E+00	4.00E+00	shoot weight	Will and Suter, 1994
Silver	2.70E+01	surface soil	---	---	2.00E+00	---	Will and Suter, 1994
Vanadium	2.60E+01	surface soil	---	---	2.50E+00	phytotoxic	Will and Suter, 1994
		surface soil	---	---	5.00E+01	phytotoxic	Will and Suter, 1994
Zinc	2.20E+02	sand:peat:soil	beech	---	3.30E+00	annual ring width	Will and Suter, 1994
		surface soil	soybean	1.00E+01	2.50E+01	seeds/plant	Will and Suter, 1994
		surface soil	corlander	---	8.70E+01	root & shoot weight	Will and Suter, 1994
		sandy loam	soybean	---	1.31E+02	leaf weight	Will and Suter, 1994
		sandy loam	soybean	---	3.93E+02	leaf weight	Will and Suter, 1994
		alluvial soil	wheat	---	1.00E+03	plant weight, grain yield	Will and Suter, 1994
		alluvial soil	rice	---	1.00E+03	root weight	Will and Suter, 1994

--- = No data available.

NTV = No plant toxicity values available.

^a No observed effect concentration (NOEC) is defined as the highest concentration which produced a reduction of 20% or less in a measured response.

^b Lowest observed effect concentration (LOEC) is defined as the lowest concentration which produced greater than a 20% reduction in a measured response. In some cases, the LOEC for a study was the lowest concentration tested or reported.

^c Due to the large number of phytotoxicity data available for cadmium, only results from studies containing both a NOEC and a LOEC were summarized.

Table 5-14
Comparison of Available Plant Toxicity Values to Hamill Road Dump #3 Maximum Soil Concentrations (0 to 2 feet deep)
Tennessee Products Site - Chattanooga, TN

Chemical	Maximum Soil Concentration (mg/kg)	Medium or Soil Type	Plant Species	No Observed Effect Concentration ^a (mg/kg)	Lowest Observed Effect Concentration ^b (mg/kg)	Effect	Reference
Organics							
Aldrin	1.30E-03	sandy loam	Bengal gram	---	1.00E+00	reduced nodulation	Kapoor et al., 1977
		sandy loam	Bengal gram	---	1.00E+01	reduced N fixation	Kapoor et al., 1977
		soil	corn	---	3.70E-01	10% decrease in size	Phytotox Database, 1996
beta-BHC	3.80E-01	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
gamma-BHC	1.10E-01	alluvial soil	groundnut	---	1.00E+00	reduced root nodulation	Misra and Gaur, 1974
		sand	pea plant	---	2.00E+00	reduced root length	Charnetski et al., 1973
		sand	pea plant	---	4.00E+00	no secondary roots	Charnetski et al., 1973
		sand	pea plant	---	8.00E+00	root cells vacuolated	Charnetski et al., 1973
		alluvial soil	groundnut	---	1.00E+01	no root nodulation	Misra and Gaur, 1974
		sand	pea plant	---	3.00E+01	no cellular organization	Charnetski et al., 1973
		alluvial soil	groundnut	---	1.00E+02	decrease in pod yield	Misra and Gaur, 1974
alpha-Chlordane	1.90E-03	soil	turfgrass	---	3.25E+01	95% reduction in germin.	Phytotox Database, 1996
DDT	4.40E-02	soil	bean	3.85E+01	---	no injury to shoots	Phytotox Database, 1996
Dieldrin	3.40E-01	soil	corn	---	1.15E+00	plant size	Phytotox Database, 1996
Endosulfan I	2.00E-01	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
Endosulfan II	5.40E-02	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
Heptachlor	9.20E-02	soil	cotton	---	1.56E+04	decrease in plant yield	Phytotox Database, 1996
Naphthalene	3.40E-01	agricultural loam	lettuce	---	1.00E+02	50% reduction in growth	Hulzebos et al., 1993
1,1,1-Trichloroethane	3.50E-02	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
Xylenes (total)	3.00E-03	agricultural loam	lettuce	---	>1.00E+03	50% reduction in growth	Hulzebos et al., 1993
Inorganics							
Aluminum	1.60E+04	silt loam	white clover	---	5.00E+01	seedling establish	Will and Suter, 1994
Arsenic	1.20E+01	sandy loam	cotton	---	1.12E+01	shoot weight	Will and Suter, 1994
		sandy loam	soybean	---	1.12E+01	shoot weight	Will and Suter, 1994
		black clay	soybean	---	2.24E+01	shoot weight	Will and Suter, 1994
		black clay	cotton	6.72E+01	8.96E+01	shoot weight	Will and Suter, 1994
		---	spruce	---	1.00E+03	height	Will and Suter, 1994
Barium	1.30E+02	loam	barley	---	5.00E+02	plant weight	Will and Suter, 1994
		loam	bush beans	1.00E+03	2.00E+03	plant weight	Will and Suter, 1994
Beryllium	1.50E+00	surface soil	---	---	1.00E+01	phytotoxic	Will and Suter, 1994
Chromium	8.60E+01	loam	oats	3.50E+00	7.40E+00	fresh shoot weight	Will and Suter, 1994
		loam	soybean	1.00E+01	3.00E+01	fresh shoot weight	Will and Suter, 1994
		humic sand	oats	1.10E+01	3.10E+01	fresh shoot weight	Will and Suter, 1994
Cobalt	1.80E+01	surface soil	---	---	2.50E+01	phytotoxic	Will and Suter, 1994
Copper	5.40E+01	sand	blue stem	---	1.00E+02	root & shoot weight	Will and Suter, 1994
		sand	blue stem	---	1.00E+02	root & shoot weight	Will and Suter, 1994
		loam	bush beans	1.00E+02	2.00E+02	leaf weight	Will and Suter, 1994

Table 5-14 (continued)
Comparison of Available Plant Toxicity Values to Hamill Road Dump #3 Maximum Soil Concentrations (0 to 2 feet deep)
Tennessee Products Site - Chattanooga, TN

Chemical	Maximum Soil Concentration (mg/kg)	Medium or Soil Type	Plant Species	No Observed Effect Concentration ^a (mg/kg)	Lowest Observed Effect Concentration ^b (mg/kg)	Effect	Reference
Lead	7.40E+01	silty clay loam	sycamore	---	5.00E+01	leaf weight	Will and Suter, 1994
		sandy loam	red oak	2.00E+01	5.00E+01	plant weight	Will and Suter, 1994
		soil+sand	spruce	5.00E+01	1.00E+02	root & shoot weight	Will and Suter, 1994
		soil:sand:peat	autumn olive	8.00E+01	1.60E+02	transpiration	Will and Suter, 1994
		sand	blue stem	---	4.50E+02	root & shoot weight	Will and Suter, 1994
		sand	blue stem	---	4.50E+02	root weight	Will and Suter, 1994
		brown earth	oats	1.00E+02	5.00E+02	root weight	Will and Suter, 1994
		brown earth	wheat	5.00E+02	1.00E+03	root weight	Will and Suter, 1994
		alluvial	wheat	3.00E+02	1.00E+03	root & shoot weight	Will and Suter, 1994
		silt loam	rye	1.00E+03	5.00E+03	shoot weight	Will and Suter, 1994
		silt loam	fescue	1.00E+03	5.00E+03	shoot weight	Will and Suter, 1994
		loam	bush beans	---	5.00E+02	stem weight	Will and Suter, 1994
Manganese	2.00E+03	loam	bush beans	---	3.00E-01	---	Will and Suter, 1994
Mercury	4.20E-01	surface soil	---	---	3.00E-01	---	Will and Suter, 1994
Nickel	2.70E+01	loam	barley	---	2.50E+01	shoot weight	Will and Suter, 1994
		sandy loam	red oak	2.00E+01	5.00E+01	plant weight	Will and Suter, 1994
		loam	bush beans	2.50E+01	1.00E+02	leaf weight	Will and Suter, 1994
		loam	bush beans	---	1.00E+02	shoot weight	Will and Suter, 1994
		loam	cotton	---	1.00E+02	leaf & stem weights	Will and Suter, 1994
		loam	ryegrass	9.00E+01	1.80E+02	shoot weight	Will and Suter, 1994
		loam	bush beans	1.00E+02	2.50E+02	shoot weight	Will and Suter, 1994
		loamy sand	sorghass	---	1.00E+00	shoot weight	Will and Suter, 1994
Selenium	2.30E+00	sand	sorghass	---	1.00E+00	shoot weight	Will and Suter, 1994
		loamy sand	sorghass	---	1.00E+00	shoot weight	Will and Suter, 1994
		sand	sorghass	---	1.00E+00	shoot weight	Will and Suter, 1994
		sandy loam	alfalfa	5.00E-01	1.50E+00	shoot weight	Will and Suter, 1994
		clay loam	alfalfa	5.00E-01	1.50E+00	shoot weight	Will and Suter, 1994
		clay loam	alfalfa	5.00E-01	1.50E+00	shoot weight	Will and Suter, 1994
		sand	sorghass	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
		silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
		silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
		silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
		silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
		silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
		silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
		silty clay loam	alfalfa	1.00E+00	2.00E+00	shoot weight	Will and Suter, 1994
Vanadium	2.60E+01	surface soil	---	---	2.50E+00	phytotoxic	Will and Suter, 1994
		surface soil	---	---	5.00E+01	phytotoxic	Will and Suter, 1994
		surface soil	---	---	5.00E+01	phytotoxic	Will and Suter, 1994

Table 5-14 (continued)
Comparison of Available Plant Toxicity Values to Hamill Road Dump #3 Maximum Soil Concentrations (0 to 2 feet deep)
Tennessee Products Site - Chattanooga, TN

Chemical	Maximum Soil Concentration (mg/kg)	Medium or Soil Type	Plant Species	No Observed Effect Concentration ^a (mg/kg)	Lowest Observed Effect Concentration ^b (mg/kg)	Effect	Reference
Zinc	1.40E+02	sand:peat:soil	beech	—	3.30E+00	annual ring width	Will and Suter, 1994
		surface soil	soybean	1.00E+01	2.50E+01	seeds/plant	Will and Suter, 1994
		surface soil	coriander	—	8.70E+01	root & shoot weight	Will and Suter, 1994
		sandy loam	soybean	—	1.31E+02	leaf weight	Will and Suter, 1994
		sandy loam	soybean	—	3.93E+02	leaf weight	Will and Suter, 1994
		alluvial soil	wheat	—	1.00E+03	plant weight, grain yield	Will and Suter, 1994
		alluvial soil	rice	—	1.00E+03	root weight	Will and Suter, 1994

— = No data available.

NTV = No plant toxicity values available.

^a No observed effect concentration (NOEC) is defined as the highest concentration which produced a reduction of 20% or less in a measured response.

^b Lowest observed effect concentration (LOEC) is defined as the lowest concentration which produced greater than a 20% reduction in a measured response. In some cases, the LOEC for a study was the lowest concentration tested or reported.

^c Due to the large number of phytotoxicity data available for cadmium, only results from studies containing both a NOEC and a LOEC were summarized.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 5
Revision: 0
Date: April 1996

manganese, mercury, nickel, selenium, silver, vanadium, and zinc. Exceedances of phytotoxicity data in soils of Hamill Road Dump No. 3 included arsenic, chromium, lead, manganese, mercury, nickel, selenium, vanadium, and zinc. These chemicals occurred at concentrations shown primarily to cause a reduction in growth. These results show that there is a potential for phytotoxic effects to occur at the site at both the Tar Dump and the Hamill Road Dump No. 3. However, during site investigations there were no signs of plant toxicity or stress (e.g., yellowing leaves, stunted growth, abnormal growth), and the plants appeared to be in good health. Thus, although the potential for reduced growth may be possible based on the phytotoxicity evaluation, it does not appear that harmful effects are occurring to the vegetation communities at the site.

5.5 RISK CHARACTERIZATION FOR SOIL INVERTEBRATES

Potential effects to soil invertebrates inhabiting the site were assessed by conducting site-specific earthworm toxicity tests. Soil samples from both the Tar Dump and Hamill Road Dump No. 3 were chosen for conducting the tests (see Section 4). The results indicated that no significant toxic effects occurred for any of the locations tested.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 6
Revision: 0
Date: April 1996

SECTION 6

UNCERTAINTY ANALYSIS

An ecological risk assessment is subject to a wide variety of uncertainties. Virtually every step in the risk assessment process involves numerous assumptions which contribute to the total uncertainty in the final evaluation of risk.

In the exposure assessment, numerous assumptions were made in order to estimate daily doses for selected indicator species (i.e., Northern short-tailed shrew, white-footed mouse, American robin, and muskrat). Since limited site-specific information was available, assumptions were made regarding chemical concentrations in food items (e.g., earthworms, plant seeds) and ingestion rates. In general, an effort was made to use assumptions that were conservative, yet realistic.

The interpretation and application of toxicological data in the toxicity assessment are probably the greatest sources of uncertainty in an ecological risk assessment. Frequently, data from literature sources are not specific to the indicator species selected, and therefore, extrapolation of the data to the species of concern is necessary. When extrapolating ecological data, every effort was made to use data from the most closely related species to the indicator organism. Even so, species sensitivities may vary even among closely related species. Variations in species sensitivity may be due to differences in some of the following factors: tolerance thresholds, toxic symptoms exhibited, time period until toxic effects are observed, and metabolism of ingested chemical.

In calculating RTVs, safety factors are applied to toxicity data to account for differences in species and differences in toxicological endpoints (e.g., LD₅₀, NOAEL, LOAEL). The safety

Ecological Risk Assessment
Tennessee Products Site
Section: Section 6
Revision: 0
Date: April 1996

factors which were applied were either recommended by the EPA, developed from literature reviews of toxicological data, or based on best professional judgment. There are uncertainties associated with applying safety factors. For example, in deriving RTVs based on data from a different species, a safety factor is used to protect for the possibility that the indicator species may be more sensitive to a chemical exposure than the test species, even though the opposite may be true. Thus, the potential exists for developing an overly protective RTV.

An additional uncertainty in developing RTVs is estimating a daily dietary dose (i.e., mg/kg-day intake) from a dose reported only as a concentration in food. Where information from the study was not available to make this conversion, average ingestion rates and body weights were used to estimate an RTV.

An uncertainty which may result in an underestimate of risk in the risk characterization is the absence of toxicity data (e.g., avian toxicity data for PAHs). In the absence of such information, the potential risk from exposure to chemicals of potential concern cannot be quantitatively evaluated.

The following text provides a brief discussion of the primary uncertainties associated with the risk evaluation for the indicator species/communities. The discussion focuses on those chemicals and/or exposure routes that are responsible for the majority of the risk.

6.1 AQUATIC LIFE

Surface Water:

- EPA Region 4 Surface Water Screening Values were not available for all COPCs. Therefore, the potential impacts to aquatic life could not be evaluated for all chemicals.
- Total metal concentrations were compared to EPA Region 4 Surface Water Screening Values. However, dissolved metal concentrations better estimate the bioavailable fraction of waterborne inorganics than total metals. EPA experts have recommended that existing water quality criteria values be applied as dissolved metal concentrations (rather than total). Therefore, the use of total metal concentrations for comparison to the Surface Water Screening Values most likely overestimates the risk to aquatic life.
- The comparison of water column concentrations with toxicity data does not account for potential exposure of aquatic life through food and sediment ingestion exposure routes, which may be significant routes of exposure for some chemicals in fish (NCASI, 1991).

Sediment:

- Many COPCs could not be evaluated due to a lack of available sediment effect values. Without appropriate criteria these contaminants could not be included in the overall risk to aquatic biota.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 6
Revision: 0
Date: April 1996

- Many of the EPA Region 4 Sediment Effect Values were based on studies in marine or estuarine environments. In addition, the subtle effect of complex mixtures of chemicals in sediments are not necessarily addressed by the chemical-specific effect levels. These deficiencies may result in an overestimation or underestimation of the actual risk to benthic and epibenthic fauna in Chattanooga Creek.
- Exceedances of PAH sediment effect values occurred in the upgradient location, DC-8U. The concentrations of PAHs at DC-8U exceeded PAH concentrations in sediments at locations DC-1, DC-2, DC-3U, and DC-9U. This suggests a contaminant source other than the Tennessee Products Site for some of the PAHs observed in the creek and its tributaries.
- There is uncertainty as to what is causing the toxicity in the *Ceriodaphnia* and Microtox tests at locations DC-5U and DC-1. Although DC-5U sediments had the highest concentrations of PAHs and naphthalenes, it is not certain whether this is the toxic element in the sediments, since concentrations of these contaminants at all other locations were also exceeding sediment effect values.

6.2 NORTHERN SHORT-TAILED SHREW

Exposure Assessment:

- It was assumed that the Northern short-tailed shrew is present at the site. This assumption is based on the similarity between habitat conditions at the site and descriptions of short-tailed shrew habitat and range in the scientific literature.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 6
Revision: 0
Date: April 1996

- The diet of the shrew in a given location is based on food availability and can consist of the following organisms: earthworms, spiders, millipedes, centipedes, sow bugs, small vertebrates, plants, and insect larvae and pupae (DeGraaf and Rudis, 1986). Since data are not available to estimate chemical concentrations in other probable food sources, exposure dose estimates were based on exclusive consumption of earthworms. Since earthworms inhabit and ingest soil, they may be more efficient accumulators of soil contaminants than some of these other organisms. Thus, the assumption of an exclusive earthworm diet may overestimate the hazard to the shrew.
- There are a number of difficulties associated with applying literature-based earthworm BAFs to a given site. Environmental variables, such as soil characteristics, obscure the underlying relationship between concentrations in soils and in earthworms. Earthworms selectively feed on plant debris and soil organic matter, and consequently, soil concentrations may not represent true exposure concentrations. Also, different earthworm species bioaccumulate chemicals at different rates (Beyer, 1990). Thus, there is uncertainty associated with applying literature-based earthworm BAFs to the Tennessee Products Site.
- It is not known how available metals and other inorganics in earthworm tissue are to predators. The presence of high levels of metals in earthworm tissue is not adequate proof that they will be absorbed by the predator (Lee, 1985). Thus, if metals are not in a bioavailable form in earthworms, they may not pose a hazard to wildlife at the site.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 6
Revision: 0
Date: April 1996

- The chemical form of a metal is an important factor in determining the level of exposure at which toxicity appears (Lee, 1985). The metal concentrations in soils at the site were analyzed as total metals, and thus the actual form of the metal in soils and in earthworms is not known. As a general rule, the more bioavailable forms of chemicals are used in toxicity tests. Thus, it is possible that the form of a metal in the earthworms at the site is in a less bioavailable form than that used in the study on which the RTV is based. In such a case, the estimated hazard from exposure to such a chemical would be overestimated. For nickel, it is important to note that the shrew RTV is based on a drinking water study in which a soluble salt of nickel was used. Nickel is most likely more available for uptake from water, as a soluble salt, than from soils or earthworms. This indicates that the hazard to nickel may have been overestimated at the site. The same is true for many of the other metals, including aluminum, lead, manganese, and vanadium.

Effects Characterization/Risk Characterization:

- No toxicity data were available specifically for the shrew; therefore, data from other small mammal species were used.
- The RTV for nickel was based on a chronic effect dose for rats, in which an increase in deaths and runts were observed in the young. A safety factor of 5 was used to extrapolate from a chronic effect dose to a safe chronic dose. It is not known whether this safety factor over- or under-estimates risk. An additional safety factor of 5 was used to extrapolate between species. If the shrew is as or less sensitive to nickel exposure than the rat, the RTV may result in an

Ecological Risk Assessment
Tennessee Products Site
Section: Section 6
Revision: 0
Date: April 1996

overestimation of risk. Also, as mentioned previously, the nickel was administered in drinking water as a soluble salt in the RTV study (Schroeder and Mitchener, 1971), which is a very bioavailable form of nickel. Although the extent of nickel bioavailability from earthworms or soil is not known, it is most likely not as bioavailable as the form of nickel in the RTV study. Thus, the use of this study to develop the nickel RTV may overestimate the risk to small mammals.

- The RTV for dieldrin was based on a Chronic NOAEL for reproductive effects (pup mortality) in female mice. The study is an 8-week feeding study. An inter-species extrapolation factor of 5 was used to derive the RTV, which may result in an overestimate of risk.
- The RTV for aluminum was based on a Chronic No Effect Dose for reproductive effects in male rats (Dixon et al., 1979). An inter-species safety factor of 5 was applied to the RTV, which may result in an overestimate of risk if the shrew is as or less sensitive to aluminum exposure compared to the rat. Also, as mentioned previously, the aluminum was administered in drinking water as a soluble salt in the RTV study, and thus may tend to overestimate the actual risks. Also, in this study, there were no effects observed in any of the tested doses, and thus the actual no effect dose may be higher than the highest dose tested. This may result in an overestimation of risk.
- Since metals occur naturally in soils, one needs to consider whether metals detected at the site are due to contamination or based on natural background levels. Table 6-1 presents means and ranges of background metal concentrations

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 6
Revision: 0
Date: April 1996

Table 6-1

Background Concentrations of Metals in U.S. Soils (mg/kg)

Chemical	Eastern U.S. Soils ^a		U.S. Various Soils ^b	
	Range	Arithmetic Mean	Range	Mean
Aluminum	7000 - > 100,000	57,000	NDA	NDA
Arsenic	<0.1 - 73	7.4	<1 - 93.2	7
Barium	10 - 1500	420	70 - 3000	560
Beryllium	<1 - 7	0.85	<1 - 5	1.6
Cadmium	NDA	NDA	0.41 - 1.5	NDA
Chromium	1 - 1000	52	7 - 1500	50
Cobalt	<0.3 - 70	9.2	3 - 50	10.5
Copper	<1 - 700	22	3 - 300	26
Iron	100 - > 100,000	25,000	5000 - 50,000	NDA
Lead	<10 - 300	17	<10 - 70	26
Manganese	<2 - 7000	640	20 - 3000	490
Mercury	0.01 - 3.4	0.12	0.02 - 1.5	0.17
Nickel	<5 - 700	18	<5 - 150	18.5
Selenium	<0.1 - 3.9	0.45	<0.1 - 4	0.31
Silver	NDA		0.01 - 8	NDA
Vanadium	<7 - 300	66	0.7 - 98	NDA
Zinc	<5 - 2900	52	10 - 300	73.5

^a Shacklette and Boerngen, 1984

^b Kabata-Pendias and Pendias, 1984

NDA - No data available

Ecological Risk Assessment
Tennessee Products Site
Section: Section 6
Revision: 0
Date: April 1996

measured in U.S. soils. The ranges that are presented often span many orders of magnitude, and are most likely a reflection of the diverse environments that were sampled. Thus, these background values can only be used as general guidance in determining whether a metal is at background levels at the site. Other factors need to be considered, such as the range and distribution of metal concentrations at the site. The metals at the site which exceeded background ranges at one or more locations were lead and silver. Lead exceeded the background range limit of 70 ppm at SC-1U, SC-2U, SC-3U, SC-3M, SC-4U, SC-6U, and SC-15U. Silver exceeded the background range at SC-3U. Some metals, such as aluminum and nickel, which are showing relatively high hazard quotients, fall within background ranges. The concentration of aluminum ranges from 1600 to 16,000 ppm at the site, with the majority of values (95%) ranging between 7000 and 16,000 ppm. This compares to a background range for aluminum of 7000 - >100,000 ppm. The concentration of nickel at the site ranges from <5 to 41 ppm, with 90% of the values greater than or equal to 10 ppm. This compares to background ranges of <5 - 700 ppm and <5 to 150 ppm, with a mean around 18 ppm. Thus, there is uncertainty associated with whether risks determined for some metals (particularly aluminum and nickel) are due to background or to site-related activities.

6.3 WHITE-FOOTED MOUSE

Exposure Assessment:

- It was assumed that the white-footed mouse is present at the site. This assumption is based on the similarity between habitat conditions at the site and descriptions of white-footed mouse habitat and range in the scientific literature.
- Chemical concentrations in plant seeds are dependent on such factors as plant species considered, site-specific conditions (i.e., soil type, soil pH, soil organic content), chemical species, etc. Plant uptake factors (PUFs) for organics were calculated based on a regression equation which incorporates chemical-specific log K_{ow}s. Uncertainty exists in using predicted values such as these. The PUFs used for inorganics were based on data from Baes et al. (1984), who derived uptake factors based on a literature review, and comparisons of observed and predicted elemental concentrations in plants (Baes et al. 1984). Inorganics can exist in soils as free ionic forms, inorganic ion pairs, inorganic complexes, organic complexes, etc., each with its own propensity toward biouptake, trophic transfer, and subsequent toxicity. Because the form of the element in the environment is difficult to predict or is seldom measured, prediction of the mobilization and uptake of metals is highly uncertain. Therefore, the concentrations of chemicals in plant seeds, and subsequent risk from ingestion of seeds, is a major uncertainty.
- The chemical form of a metal is an important factor in determining the level of exposure at which toxicity appears (Lee, 1985). The metal concentrations in soils

Ecological Risk Assessment
Tennessee Products Site
Section: Section 6
Revision: 0
Date: April 1996

at the site were analyzed as total metals, and thus the actual form of the metal in soils and in plants is not known. As a general rule, the more bioavailable forms of chemicals are used in toxicity tests. Thus, it is possible that the form of a metal in plants at the site is in a less bioavailable form than that used in the study on which the RTV is based. In such a case, the estimated hazard from exposure to such a chemical would have been overestimated. As discussed for the shrew, the nickel RTV is based on a drinking water study in which a soluble salt of nickel was used. Nickel is most likely more available from water, as a soluble salt, than from soils or plants. This indicates that the hazard to nickel may have been overestimated at the site.

Effects Characterization/Risk Characterization:

- White-footed mouse toxicity data were not available for any chemicals of concern; therefore, interspecies extrapolation was required for all of the chemicals of concern. If the white-footed mouse is as or less sensitive to a chemical as compared to the test species, then the risk to the mouse will be overestimated.
- There is considerable uncertainty associated with the RTVs derived for nickel, as discussed under the uncertainty analysis for the shrew.
- As discussed for the shrew, there is uncertainty associated with whether risks determined for some metals are due to background or to site-related activities.

6.4 AMERICAN ROBIN

Exposure Assessment:

- The diet of the robin in a given location is based on food availability and can consist of the following organisms: earthworms, grasshoppers, beetles, cicadas, ants, termites, cutworms, caterpillars, butterflies, and berries (Terres, 1991). Since data are not available to estimate chemical concentrations in other probable food sources, exposure dose estimates were based on exclusive consumption of earthworms. Since earthworms inhabit and ingest soil, they may be more efficient accumulators of soil contaminants than some of these other organisms. Thus, the assumption of an exclusive earthworm diet may overestimate the hazard to the robin.
- As discussed under the uncertainty analysis for the shrew, there are many uncertainties associated with using literature-based bioaccumulation factors for earthworms.
- As discussed under the uncertainty analysis for the shrew, it is not known how available the metals and other inorganics in earthworm tissue are to predators.

Effects Characterization/Risk Characterization:

- No toxicity data were available for the robin; therefore, data from other bird species were used.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 6
Revision: 0
Date: April 1996

- Toxicity data for avian species were not available for PAHs; therefore, the potential risk from exposure to these chemicals could not be estimated for the robin.
- The RTV for aluminum was based on a chronic NOAEL for food intake and egg production for the Japanese quail (Hussein et al., 1988). An inter-species safety factor of 5, which was applied to the RTV, may result in an overestimate of risk if the robin is as or less sensitive to aluminum exposure compared with the quail. The aluminum was administered in the diet in the form of a soluble salt (aluminum sulfate), which is a very bioavailable form of aluminum. Although the extent of aluminum bioavailability from earthworms or soil is not known, it is most likely not as bioavailable as the form of aluminum in the RTV study. Thus, the use of this study to develop the aluminum RTV may overestimate the risk to omnivorous songbirds.
- The RTV for dieldrin was based on an acute LC50 for bobwhite quail (Heath et al., 1972). A safety factor of 5 was used to extrapolate to an acute NOEL, and an additional safety factor of 5 was applied for inter-species extrapolation. If the robin is less sensitive to dieldrin exposure than the quail, the potential risks may be overestimated. However, it is important to note that this RTV does not account for the potential for chronic effects to occur, due to a lack of avian chronic toxicity studies for dieldrin.
- The RTVs for acetone, gamma-BHC, chlordane, DDD, dieldrin, endosulfan, heptachlor, methoxychlor, naphthalene, xylene, manganese, nickel, and cyanide are based on acute endpoints, and extrapolated to acute no effect levels. The

potential for chronic effects to occur based on exposure to these chemicals could not be evaluated due to a lack of sufficient chronic toxicity data.

- As discussed for the shrew, there is uncertainty associated with whether risks determined for some metals, such as aluminum, are due to background or to site-related activities.

6.5 MUSKRAT

Exposure Assessment:

- The diet of the muskrat varies widely depending on habitat, season, and availability, and can consist of the following organisms: aquatic plants, fish, mussels, clams, insects, crayfish, and snails (Chapman and Feldhamer, 1982). Since data are not available to estimate chemical concentrations in other probable food sources, exposure dose estimates were based on exclusive consumption of clams. It is uncertain whether this assumption may over- or under-estimate potential risk.
- The chemical form of a metal is an important factor in determining the level of exposure at which toxicity appears (Lee, 1985). The metal concentrations in clams at the site were analyzed as total metals, and thus the actual form of the metal in clams is not known. As a general rule, the more bioavailable forms of chemicals are used in toxicity tests. Thus, it is possible that the form of a metal in clams at the site is in a less bioavailable form than that used in the study on

Ecological Risk Assessment
Tennessee Products Site
Section: Section 6
Revision: 0
Date: April 1996

which the RTV is based. In such a case, the estimated hazard from exposure to such a chemical would have been overestimated.

Effects Characterization/Risk Characterization:

- The risks estimated for the muskrat are driven by metals obtained through clam ingestion. However, the metal concentration in clams collected in areas that may be impacted by the site (downgradient of the Hamill Road Bridge) were lower or similar to metal concentrations detected in the upgradient sample. Thus, it appears that metal levels in clams are at background levels, and the estimated risks are at background levels. However, since only one background sample was collected there is some uncertainty associated with this conclusion.
- No toxicity data were available specifically for the muskrat; therefore, data from other mammal species were used.
- The RTV for titanium was based on a Chronic Effect Dose for reproductive effects in rats. One dose of titanium was administered in drinking water, and resulted in a marked reduction in the numbers of animals surviving to the third generation. Since only one dose was tested, there was no associated NOAEL. Thus, a safety factor of 5 was used to extrapolate to a chronic NOAEL. This may result in an overestimation of risk if the true NOAEL is less than 5 times lower than the effect dose. An inter-species safety factor of 5, which was applied to the RTV, may result in an overestimate of risk if the muskrat is as or less sensitive to titanium exposure compared with the rat.

- There is considerable uncertainty associated with the RTV derived for nickel, as discussed under the uncertainty analysis for the shrew.

6.6 TERRESTRIAL VEGETATION

- Since phytotoxic effects are plant species-specific and directly related to ambient conditions (i.e., soil type, soil pH, moisture content etc.), comparison of literature-based phytotoxicity data to soil concentrations at the Tennessee Products Site may not accurately illustrate potential hazards to on-site plants.
- Phytotoxicity of metals is dependent on the chemical form of the metal that was used in the study. If the form of the metal used in the phytotoxicity studies is in a more available form than the metal in site soils, then the potential for phytotoxic effects to occur would be overestimated.
- Some secondary references from which phytotoxicity data were taken do not provide information on the plant species used in the studies, or endpoints that were measured. For example, Will and Suter (1994) provide "phytotoxically excessive" levels, but do not provide any details on plant species or toxicological endpoints. Thus, there is uncertainty as to what these values represent.
- As discussed for the shrew, there is uncertainty associated with whether some metal concentrations at the site are due to background or to site-related activities.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 6
Revision: 0
Date: April 1996

6.7 SOIL INVERTEBRATES

- Soil toxicity tests were conducted using earthworms, since this is a widely used test organism. Although earthworms serve as a surrogate for determining the potential for toxicity to occur to soil invertebrates, there may be other soil invertebrates at the site that are more sensitive to chemical exposures than the earthworm.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 7
Revision: 1
Date: April 1999

SECTION 7 CONCLUSIONS

7.1 RESULTS OF THE ECOLOGICAL RISK ASSESSMENT

The results of the ecological risk assessment show the potential for adverse effects to occur to aquatic life in Chattanooga Creek, and insectivorous small mammals and omnivorous songbirds feeding along the floodplain of the creek in the Tar Dump and Hamill Road Dump No. 3. There were also some minor risks estimated for herbivorous small mammals, muskrats, and terrestrial plants at the Tennessee Products Site.

Potential risks to aquatic life were assessed by comparing surface water and sediment concentrations with criteria and guidelines, and by conducting site-specific sediment toxicity tests. Exceedances of criteria and guidelines occurred at all sampling locations. Number of exceedances were particularly high for sediments, and included PAHs, naphthalenes, and pesticides. Although the exceedances of criteria and guidelines indicated the potential for toxicity at all locations (including background), the sediment toxicity tests only indicated toxicity at locations DC-5U (Microtox and *Ceriodaphnia* tests) and DC-1 (*Ceriodaphnia* test only). The concentrations of PAHs and naphthalenes in sediments were particularly high for DC-5U. However, it is not certain whether this accounts for the observed toxicity. It is also not certain what accounts for the toxicity in DC-1.

For terrestrial mammals, the highest hazard index was based on potential exposure to nickel. The nickel hazard indices observed for insectivorous mammals (i.e., 410 - Tar Dump; 310 - Hamill Road Dump) were higher than those observed for herbivorous mammals (i.e., 17 - Tar Dump; 14 - Hamill Road Dump). The hazard indices for insectivorous mammals were also fairly high for aluminum (59 - Tar Dump; 79 - Hamill Road Dump) and dieldrin (110 - Tar

Ecological Risk Assessment
Tennessee Products Site
Section: Section 7
Revision: 1
Date: April 1999

Dump). The principal contributor to the hazard index for nickel, aluminum, and dieldrin, as well as most of the other contaminants, was the potential bioconcentration and exposure through earthworm or seed ingestion. The RTV basis for all of these compounds is the protection against adverse reproductive effects. Thus, the results show the potential for adverse reproductive effects in small mammals feeding at the site, particularly for small mammals feeding on earthworms. The potential risks from exposure at the Tar Dump are higher than those at Hamill Road Dump No. 3.

There are, however, some fairly significant uncertainties associated with the estimated risks for nickel and aluminum. First, the concentrations of nickel and aluminum at the site fell within the means and ranges of background nickel concentrations measured in U.S. soils (Table 6-1). Thus, it is uncertain whether the nickel and aluminum concentrations are based on site-related activities or background concentrations. Second, there is uncertainty associated with the basis of the RTVs. In the RTV studies for nickel and aluminum, the metal was administered in drinking water as a soluble salt, which is a very bioavailable form, and thus may tend to overestimate risk based on nickel and aluminum exposure at the site. In addition, the RTV for aluminum was based on a Chronic No Effect Dose with no associated effect dose. Thus, the actual no effect dose may be higher, resulting in an overestimation of risk for aluminum.

In addition to nickel, aluminum, and dieldrin, there were a number of other chemicals that exceeded a hazard index of one for small mammals, and included beta-BHC, gamma-BHC, lead, manganese, and zinc for the insectivorous small mammals, and acetone, manganese, and zinc for the herbivorous small mammals. These hazard indices were generally much lower, and ranged from 1.5 to 16 for the insectivorous mammals, and 1.6 to 5.2 for herbivorous mammals.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 7
Revision: 1
Date: April 1999

The highest hazard index observed for omnivorous song birds was based on exposure to aluminum (210 - Tar Dump; 260 - Hamill Road Dump). The next highest hazard index observed was 34 for dieldrin (Tar Dump). The principal contributor to the hazard index for these chemicals, as well as for others, was the earthworm ingestion exposure route. There are some uncertainties associated with whether aluminum is at background levels, as mentioned for the insectivorous mammals. The RTV for aluminum was based on a study in which aluminum was administered in the diet in the form of a soluble salt. This may potentially overestimate the risk to aluminum, if the form of aluminum in earthworms and soils is not as bioavailable as that used in the study. The RTV for dieldrin was based on an acute LC50 for the bobwhite quail.

This RTV is based on acute effects, and does not take into account the potential for chronic effects. Other chemicals which exceeded a hazard index of one included DDT, endrin, heptachlor, chromium, lead, mercury, nickel, vanadium, and zinc, with hazard indices ranging from 1.2 to 7.2. Thus, the results show the potential for adverse reproductive effects in omnivorous songbirds feeding at the site.

For the muskrat, several metals exceeded a hazard index of one, the highest of which was titanium (13). The principal contributor to the hazard index for all chemicals was the clam ingestion exposure route. The concentrations of metals in clams, for the metals which exceeded a hazard index of one, were at or below background concentrations. The results indicate that risks are at background levels, and there is a very limited potential for adverse effects to occur to muskrats, or similar organisms feeding in Chattanooga Creek.

A comparison of soil concentrations at the site with phytotoxicity data show the potential for phytotoxic effects to occur at the site. Exceedances of phytotoxicity data in Tar Dump soils occurred for gamma-BHC, dieldrin, aluminum, arsenic, chromium, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc. Exceedances of phytotoxicity data in soils of

Ecological Risk Assessment
Tennessee Products Site
Section: Section 7
Revision: 1
Date: April 1999

Hamill Road Dump No. 3 included arsenic, chromium, lead, manganese, mercury, nickel, selenium, vanadium, and zinc. These chemicals occurred at concentrations on the site which have been shown primarily to cause growth reduction. However, during site investigations there were no signs of plant toxicity or stress (e.g., yellowing leaves, stunted growth, abnormal growth). Thus, although the potential for reduced growth may be possible based on the phytotoxicity evaluation, it does not appear that harmful effects are occurring to the vegetation communities at the site.

Site-specific earthworm toxicity tests were conducted to evaluate the potential for effects on soil invertebrates. The results indicated that no significant toxic effects occurred for any of the locations tested in the Tar Dump and Hamill Road Dump No. 3.

7.2 RESULTS OF THE SEDIMENT TOXICITY AND BIOACCUMULATION STUDIES

After the April, 1996 ecological risk assessment was published, the EPA identified two areas in which the conclusions of the initial ecological risk evaluation should be refined with site-specific data: sediment toxicity and bioaccumulation. This subsection summarizes the results of these supplemental studies.

Sediment toxicity tests were conducted using samples of coal tar and sediment collected from the creek and juvenile amphipods and chironomid (midge) larvae. Sediment samples were submitted for chemical analysis.

The sediment toxicity test results showed that the sediments were toxic to both subject organisms, the amphipod, *Hyalella azteca*, and the midge, *Chironomus tentans*. Percent survival for the test organisms in the test sediments was significantly lower than percent survival in both

Ecological Risk Assessment
Tennessee Products Site
Section: Section 7
Revision: 1
Date: April 1999

the reference and control sediments. A growth study could not be conducted using the amphipod because of the low survival of the test organisms. Mean growth of the midge was significantly lower in the test sediments than in the reference and control sediments.

The results of the sediment toxicity tests indicate that coal tar is toxic to benthic invertebrates. Exposure to coal tar compounds in the Chattanooga Creek was demonstrated. The weight of evidence suggests that coal tar is posing a risk to the survival and growth of benthic invertebrates in Chattanooga Creek.

An earthworm bioaccumulation study was conducted using site soil samples. No differences were observed in either survival or growth of earthworms in any of the test soils compared to either the reference or control soils. This result is consistent with the earthworm toxicity test performed in 1996.

Earthworm tissue concentrations measured at the end of the 28-day bioaccumulation study were entered into the exposure models for worm-eating mammals and birds to obtain a more realistic assessment of risks associated with that pathway. The contaminants evaluated were those which had presented a risk in the April 1996 risk assessment, as follows:

Contaminants Evaluated for Worm-eating Birds:

Aluminum
Chromium
Lead
Manganese
Mercury
Nickel

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 7
Revision: 1
Date: April 1999

Vanadium

Zinc

DDT

Dieldrin

Endrin

Heptachlor

Contaminants Evaluated for Worm-Eating Mammals:

Aluminum

Lead

Manganese

Nickel

Zinc

b-BHC

g-BHC

Dieldrin

The data obtained from the analysis of worm-eating birds indicated that survival, growth, and reproduction of worm-eating birds may be at risk from aluminum, lead and vanadium. However, the hazard quotients were relatively low for these contaminants. The hazard quotient for aluminum probably overpredicts risks, and the hazard quotients for lead and vanadium did not exceed one when the lowest observable adverse effects level (LOAEL) was used as the measurement endpoint. Nevertheless, lack of risk cannot be concluded.

The data obtained from the analysis of worm-eating mammals indicate that survival, growth and reproduction of worm-eating mammals may be at risk from aluminum, lead, managanese, nickel,

Ecological Risk Assessment
Tennessee Products Site
Section: Section 7
Revision: 1
Date: April 1999

and dieldrin. However, the hazard quotients for manganese were relatively low, the hazard quotients for lead, nickel and dieldrin were relatively low and did not exceed one using the LOAELs, and the hazard quotient for aluminum were probably overpredictive of risk. Nevertheless, a lack of risk for these compounds cannot be concluded.

There are numerous sources of uncertainty that must be considered in interpreting the results of this type of assessment. Sources of uncertainty in this risk assessment include the following:

- Natural variability in biological and chemical systems and their combined behavior in the environment.
- The introduction of error in the process embedded in the literature that was used for obtaining life history and toxicity information.
- Data gaps, particularly incomplete contaminant data sets, missing life history, and absence of toxicity-based literature for the receptor of concern.

Conservative assumptions were made to minimize the possibility of concluding that risk is not present when a threat actually does exist. This results in error on the side of a protective outcome. When the results of the sediment toxicity analysis and bioaccumulation studies are evaluated in the context of pertinent potential uncertainties, the following conclusions can be made:

- Survival, growth and reproduction of aquatic life in the Chattanooga Creek are at risk from the coal tar deposits that are currently present in the sediments of the creek.
- Survival, growth and reproduction of worm-eating birds may be at risk from aluminum, lead and vanadium. However, lead and vanadium levels are already within an acceptable ecotoxicologically-based remedial goal range, and the risk model assumptions for aluminum suggest that there is a high degree of uncertainty that ecological risk exists from this element.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 7
Revision: 1
Date: April 1999

-Survival, growth and reproduction of worm-eating mammals may be at risk from aluminum, lead, manganese, nickel and dieldrin. However, lead and nickel levels are already within an acceptable ecotoxicologically-based remedial goal range. Further, the risk assumptions for aluminum and manganese suggest that there is a high degree of uncertainty that ecological risk exists from these elements.

Appendix E presents the complete *Supplemental Investigation for the Ecological Risk Assessment of the Chattanooga Creek/Tennessee Products Superfund Site* (EPA, 1999).

Ecological Risk Assessment
Tennessee Products Site
Section: Section 8
Revision: 1
Date: April 1999

SECTION 8

REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 1992a. *Toxicological Profile for Methoxychlor*.

ATSDR (Agency for Toxic Substances and Disease Registry). 1992b. *Toxicological Profile for Styrene*. PB93-110849.

Barnett, F. 1994. Tennessee Products Site, RPM, U.S. Environmental Protection Agency, Region IV. Atlanta, Georgia. Personal Communication.

Baes, C.F., R.D. Sharp, A.L. Sjoreen, and R.W. Shor. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*. Oak Ridge National Laboratory, Oak Ridge, TN. ORNL-5786.

Bell, P.R. 1992. *Green Plants: Their Origins and Diversity*. Discordes Press, Portland Oregon. 315 pp.

Berg, L.R., G.E. Bearse, and L.H. Merrill. 1963. Vanadium Toxicity in Laying Hens. *Poult. Sci.* 42:1407.

Beyer, W.N. 1990. *Evaluating Soil Contamination*. U.S. Fish and Wildlife Service Biological Report 90(2).

Beyer, W.N. and E.J. Cromartie. 1987. A Survey of Pb, Cu, Zn, Cd, Cr, As, and Se in earthworms and soil from diverse sites. *Environ. Monitoring and Assessment* 8:27-36.

Beyer, W.N. and C.D. Gish. 1980. Persistence in Earthworms and Potential Hazards to Birds of soil applied DDT, Dieldrin, and Heptachlor. *J. of Appl. Ecol.* 17:295-307.

Beyer, W.N. and C. Stafford. 1993. Survey and Evaluation of Contaminants in Earthworms and in Soils Derived from Dredged Material at Confined Disposal Facilities in the Great Lakes Region. *Environ. Monitoring and Assessment* 24:151-165.

Burt, W.H. and R.P. Grossenheider. 1976. *A Field Guide to the Mammals*. Houghton Mifflin Co., Boston, MA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 8
Revision: 1
Date: April 1999

Chandra, S.V. 1983. Psychiatric Illness Due to Manganese Poisoning. *Acta Psychiatr. Scand.* 67(Suppl 303):49-54.

Chapman, J.A. and G.A. Feldhamer. 1982. *Wild Mammals of North America: Biology, Management, and Economics*. John Hopkins University Press, Baltimore, Maryland, p. 1147.

Charnetski, W.A., E.P. Lichtenstein, and R.F. Evert. 1973. Effects of Lindane on Cell Structure of Pea Plants. *Canada Journal of Botany* 51: 2111-2117.

Churchfield, S. 1990. *The Natural History of Shrews*. Comstock Publishing Associates, Ithaca, New York.

Clement, J.G. and A.B. Okey. 1974. Reproduction in Female Rats Born to DDT-Treated Parents. *Bull. Envir. Contamin.* 12(3):373-377.

Collins, H.H., Jr. and N.R. Boyajian. 1965. *Familiar Garden Birds of America*. Harper and Row, New York, NY.

Davison, K.L. and J.L. Sell. 1974. DDT Thins Shells of Eggs from Mallard Ducks Maintained on *Ad Libitum* or Controlled-Feeding Regimens. *Archives of Environ. Contam. and Toxicol.* 2(3):222-232.

DeGraaf, R.M. and D.D. Rudis. 1986. *New England Wildlife: Habitat, Natural History, and Distribution*. U.S. Dept. of Agriculture, Forest Service, Northeastern Forest Experiment Station. General Technical Report NE-108.

Delos, C. 1996. Personal communication. U.S. EPA. March 27, 1996.

Den Tonkelaar, E.M. and G.J. Van Esch. 1974. No-Effect Levels of Organochlorine Pesticides Based on Induction of Microsomal Liver Enzymes in Short-Term Toxicity Experiments. *Toxicol.* 2:371-380.

Dietz, D.D., et al. 1991. Toxicity Studies of Acetone Administered in The Drinking Water of Rodents. *Fundam. Appl. Toxicol.* 17:347-360.

Dietz, D.D., M.R. Elwell., W.E. Davis Jr., and E.F. Meirhenry. 1992. Subchronic toxicity of barium chloride dihydrate administered to rats and mice in the drinking water. *Fundam. Appl. Toxicol.* 19:527-537.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 8
Revision: 1
Date: April 1999

Dixon, R.L., R.J. Sherins, and I.P. Lee. 1979. Assessment of Environmental Factors Affecting Male Fertility. *Envir. Health Perspect.* 30:53-68.

Dow Chemical Co. 1959. MRID No. 00062676. Available from EPA. Write to FOI, EPA, Washington, DC. 20460. As cited in IRIS 1996.

Dunning, J.B. 1984. *Body Weights of 686 Species of North American Birds*. Western Bird Birding Association, Monograph No. 1, Cove Creek, Arizona.

Dynamac. 1992. "Environmental Quality of Chattanooga Creek". Technical Report prepared for the U.S. Environmental Protection Agency, Region IV, Waste Management Division - RCRA and Federal Facilities Branch. Atlanta, Georgia.

EHRV (Electronic Handbook of Risk Assessment Values). 1996. Electronic Handbook Publishers, Inc., Bellevue, WA..

EPA (U.S. Environmental Protection Agency) 1999. *Supplemental Investigation for the Ecological Risk Assessment of the Chattanooga Creek/Tennessee Products Superfund Site, Chattanooga, TN February, 1999*, prepared by Roy F. Weston, Inc. under the Environmental Response Team/Response Engineering and Analytical Contract, Work Assignment No. 3-335.

EPA. 1994. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*. Review Draft.

EPA. 1993a. *Wildlife Exposure Factors Handbook*. Volumes I and II. EPA/600/R-93/187a and 187b. Office of Research and Development, Washington DC.

EPA. 1993b. *Sediment Quality Criteria for the Protection of Benthic Organisms: Fluoranthene*. EPA-822-R-93-012. Office of Science and Technology.

EPA. 1993c. *Sediment Quality Criteria for the Protection of Benthic Organisms: Acenaphthene*. EPA-822-R-93-013. Office of Science and Technology.

EPA. 1993d. *Sediment Quality Criteria for the Protection of Benthic Organisms: Phenanthrene*. EPA-822-R-93-014. Office of Science and Technology.

EPA. 1993e. *Sediment Quality Criteria for the Protection of Benthic Organisms: Dieldrin*. EPA-822-R-93-015. Office of Science and Technology.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 8
Revision: 1
Date: April 1999

EPA. 1992a. *Framework for Ecological Risk Assessment*. Risk Assessment Forum. EPA/603/R-92/001.

EPA. 1992b. "Chattanooga Creek Sediment Profile Study, Chattanooga, Tennessee, April/August 1992". U.S. Environmental Protection Agency, Region IV. Environmental Services Division - Hazardous Waste Section. Athens, Georgia.

EPA. 1992c. "Ecological Assessment of Chattanooga Creek, Chattanooga, Tennessee, Final Report". U.S. Environmental Protection Agency, Region IV. Environmental Services Division - Ecological Support Branch. Athens, Georgia.

EPA. 1992d. "Supplemental Guidance to RAGS: Calculating the Concentration Term". Office of Solid Waste and Emergency Response, Washington, DC. Publication 9285.7-081. Intermittent Bulletin, Vol.1, No. 1.

EPA. 1992e. *Handbook of RCRA Ground-Water Monitoring Constituents - Chemical and Physical Properties (40 CFR Part 264, Appendix 9)* Office of Solid Waste. Washington DC. PB92-233287.

EPA. 1991a. *Summary Report on Issues in Ecological Risk Assessment*. EPA/625/3-91/018.

EPA. 1991b. "Review of Critical Toxicity Values (CTVs) for Ecological Risk Assessments". Technical Memorandum from Ann Sergeant (EPA HQ) to Pei-Fung Hurst (ECAO-Cin).

EPA. 1989a. *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference*. Environmental Research Laboratory. EPA/600/3-89/013.

EPA. 1989b. *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual*. Office of Emergency and Remedial Response. EPA-540-1-89-001.

EPA. 1989c. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual*. Office of Emergency and Remedial Response. EPA-540-1-89-002.

EPA. 1987. *Processes, Coefficients, and Models for Simulating Toxic Organics and Heavy Metals in Surface Waters*. Envir. Research Laboratory. Athens, GA. EPA/600/3-87/015.

EPA. 1986. *Ecological Risk Assessment*. Office of Pesticide Programs, Washington, DC. EPA/540/9-85/001.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 8
Revision: 1
Date: April 1999

EPA Region 4. 1995a. *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment*. Office of Health Assessment. Draft.

EPA Region 4. 1995b. *Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment*. Office of Health Assessment. Interim.

Fitzhugh, O.G., A.A. Nelson, E.P. Laug, and F.M. Kunze. 1950. Chronic Oral Toxicities of Mercuri-Phenyl and Mercuric Salts. *AMA Arch. Ind. Hyg. and Occup. Med.* 2:433-442.

Gilbert, R.O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. Van Nostrand Reinhold Company, New York, NY.

Gish, C.D. 1970. Pesticides in Soil. *Pest. Monitor. J.* 3:241-252.

Graber, R.R., J.W. Graber, and E.L. Kirk. 1971. Illinois Birds: Turdinae. *Illinois National History Survey Biol. Notes.* 75:1-44.

Green, V. 1970. Effects of Pesticides on Rat and Chick Embryo. In: Hemphill, D. (ed.) Trace Substances in Environmental Health. *Proceedings of the University of Missouri 3rd Annual Conference.* 2:183-209.

Guyatt, B.L., H.D. Kay, and H.D. Branion. 1933. Beryllium "rickets". *J. Nutr.* 6:313-324.

Hamid, J., A. Sayeed, and H. McFarlane. 1974. The Effect of 1-(o-chlorophenyl)-1-(p-chlorophenyl)-2,2-dichloroethane(o,p'-DDD) on the Immune Response in Malnutrition. *Br. J. Exp. Path.* 55:94-100.

Harris, S.J., H.C. Cecil, J. Bitman. 1974. Effect of several dietary levels of technical methoxychlor reproduction in rats. *J. Agric. Food Chem.* 22:969-973. As cited in ATSDR, 1992a.

Hayes, J.R., L.W. Condie, and J.F. Borzelleca. 1986. The Subchronic Toxicity of Tetrachloroethylene (Perchloroethylene) Administered in the Drinking Water of Rats. *Fundam. Appl. Toxicol.* 7(1):119-125.

Heath, R.G., J.W. Spann, E.F. Hill, and J.F. Kreitzer. 1972. Comparative Dietary Toxicities of Pesticides to Birds. U.S. Fish and Wildlife Service. Fur. Fish. and Wildlife, Special Scientific Report, Wildlife No. 152. Washington, DC.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 8
Revision: 1
Date: April 1999

Heinz, G.H., D.J. Hoffman, and L.G. Gold. 1989. Impairment Reproduction of Mallards Fed an Organic Form of Selenium. *J. Wildl. Manage.* 53:418-428.

Hill, E.F. and M.B. Camardese. 1986. Lethal Dietary Toxicities of Environmental Contaminants and Pesticides to *Coturnix*. Fish and Wildlife Service Technical Report No. 2. Washington, DC.

Hill, C.H., and G. Matrone. 1970. Chemical Parameters in the Study of In-Vivo and In-Vitro Interactions of Transition Elements. *Fed. Proc.* 29(4):1474-1481.

Hill, E.F. and C.S. Shaffner. 1976. Sexual Maturation and Productivity of Japanese Quail Fed Graded Concentrations of Mercuric Chloride. *Poult. Sci.* 55:1449.

Hill, E.F., R.G. Heath, J.W. Spann, and J.D. Williams. 1975. Lethal Dietary Toxicities of Environmental Pollutants to Birds. U.S. Fish and Wildlife Service. Special Scientific Report - Wildlife No. 191. Washington, DC.

Hulzebos, E.M., D.M.M. Adema, E.M. Dirven-van Breemen, L. Henzen, W.A. van Dis, H.A. Herbold, J.A. Hoekstra, R. Baerselman, and C.A.M. van Gestel. 1993. Phytotoxicity Studies with *Lactuca sativa* in Soil and Nutrient Solution. *Environmental Toxicology and Chemistry* 12: 1079-1094.

Hussein, A.S., A.H. Cantor, and T.M. Johnson. 1988. Use of High Levels of Dietary Aluminum and Zinc for Inducing Pauses in Egg Production of Japanese Quail. *Poult. Sci.* 67:1151-1165.

IRIS (Integrated Risk Information System). 1996. U.S. EPA. National Library of Medicine. On-line computer database.

Ito, N., H. Nagasaki, M. Arai, S. Sugihara, and S. Makiura. 1973. Histologic and Ultrastructural Studies on the Hepatocarcinogenicity of Benzene Hexachloride in Mice. *J. Nat. Cancer Inst.* 51:817-826.

Ivankovic, S. and R. Preussmann. 1975. Absence of Toxic and Carcinogenic Effects After Administration of High Doses of Chromic Oxide Pigment in Subacute and Long-Term Feeding Experiments in Rats. *Food Cosmet. Toxicol.* 13:347-451.

Kabata-Pendias, A.K. and H. Pendias. 1984. *Trace Elements in Soil and Plants*. CRC Press, Inc., Boca Raton, FL.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 8
Revision: 1
Date: April 1999

Kapoor, K.K., D.P. Singh, K.C. Khandelwal, and M.M. Miska. 1977. Effect of Aldrin on Nodulation, Nitrogen Fixation and Yield of Bengal Gram (*cicer arietinum*). *Plant and Soil* 47: 249-252.

Khasawinah, A.M. and J.F. Grutsch. 1989. Chlordane: Thirty-Month Tumorigenicity and Chronic Toxicity Test in Rats. *Reg. Toxicol. Pharmacol.* 10:95-109.

Kotsonis, F.N. and C.D. Klaassen. 1978. The Relationship of Metallothionein to the Toxicity of Cadmium. *Toxicol. Appl. Pharmacol.* 46:39-54.

Kuchler, A.W. 1964. *Potential Natural Vegetation of the Conterminous United States* (Map and Illustrated Manual). American Geographical Society, New York, New York.

Lane, R.W., L.B. Riddle, and J.F. Borzelleca. 1982. Effects of 1,2-Dichloroethane and 1,1,1-Trichloroethane in Drinking Water on Reproduction and Development in Mice. *Toxicol. Applied Pharm.* 63:409-421.

Lecyk, M. 1980. Toxicity of Cupric Sulfate in Mice Embryonic Development. *Zool. Pol.* 28:101-105.

Lee, K.E. 1985. *Earthworms. Their Ecology and Relationships with Soils and Land Use*. Academic Press, New York, NY.

Lewis, S.C., J.R. Lynch, and A. I. Nikiforov. 1990. A New Approach to Deriving Community Exposure Guidelines from No-Observed-Adverse-Effect Levels. *Reg. Toxicol. Pharm.* II. 314-330.

Llobet, J.M., M.T. Colomina, J.J. Sirvent, J.L. Domingo, and J. Corbella. 1993. Reproductive Toxicity Evaluation of Vanadium in Male Mice. *Toxicology* 80:199-206.

Luster, M.I., et al. 1978. Depression of Humoral Immunity in Rats Following Chronic Development Lead Exposure. *J. Envir. Pathol. Toxicol.* 1:397-402.

Maughan, J.T. 1993. *Ecological Assessments of Hazardous Waste Sites*. Van Nostrand Reinhold. New York, New York.

Mehring, A.L. Jr., J.H. Brumbaugh, A.J. Sutherland, and H.W. Titus. 1960. The Tolerance of Growing Chickens for Dietary Copper. *Poult. Sci.* 39:713-719.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 8
Revision: 1
Date: April 1999

Merritt, J.F. 1987. *Guide to the Mammals of Pennsylvania*. University of Pittsburgh Press. Pittsburgh, PA.

Misra, K.C. and A.C. Gaur. 1974. Influence of Simazine, Lindane and Ceresan on Different Parameters of Nitrogen Fixation by Groundnut. *Indian Journal of Agricultural Science* 44(12): 837-840.

Morgan, G.W., F.W. Edens, P. Thaxtona, and C.R. Parkhurst. 1975. Toxicity of Dietary Lead in Japanese Quail. *Poult. Sci.* 54:1636.

Nagy, K.A. 1987. Field Metabolic Rate and Food Requirement Scaling in Mammals and Birds. *Ecol. Monogr.* 57(2):111-128.

Nation, J.R., et al. 1983. The Effects of Chronic Cobalt Exposure on Behavior and Metallothionein Levels in the Adult Rat. *Neurobehav. Toxicol. Teratol.* 5:9-15.

ASI (National Council of the Paper Industry for Air and Stream Improvement). 1991. A Critical Review of the Literature on the Bioaccumulation of 2,3,7,8-Tetrachloro-dibenzo-p-dioxin and Furan in Fish. Technical Bulletin No. 610.

Nobunaga, T., H. Satoh, and T. Suzuki. 1979. Effects of Sodium Selenite on Methylmercury. *Toxicol. Appl. Pharmacol.* 47:79-88.

Norton, S.B., D.J. Rodier, J.H. Gentile, W.H. Van der Schalie, W.P. Wood, and M.W. Slimak. 1992. A Framework for Ecological Risk Assessment at the EPA. *Envir.Tox. Chem.* 11:1663-1672.

NTP (National Toxicology Program). 1985. Trichloroethylene: Reproduction and Fertility Assessment in CD-1 Mice When Administered in Feed (CAS no. 79-01-6) Final Report. Research Triangle Park, NC: *National Toxicology Program*, NIEHS, NIH.

Oh, S.H., H. Nakaue, J.T. Deagen, P.D. Whanger, and G.H. Arscott. 1979. Accumulation and Depletion of Zinc in Chick Tissue Metallothionein. *J. Nutr.* 109:1720-1729.

OMOE (Ontario Ministry of the Environment). 1993. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*. Prepared by D. Persaud, R. Jaagumagi., and A. Hayton. ISBN 0-7778-9248-7.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 8
Revision: 1
Date: April 1999

Opresko, D.M., B.E. Sample, and G.W. Suter II. 1994. *Toxicological Benchmarks for Wildlife: 1994 Revision*. Prepared by Oak Ridge National Laboratory. Prepared for U.S. Dept. of Energy. ES/ER/TM-86/RI.

Peterson, R.P. and L.S. Jensen. 1975. Interrelationship of Dietary Silver with Copper in the Chick. *Poult. Sci.* 54:771-775.

Phytotox Database, 1996. Computerized Database on the Effect of Organic Chemicals on Terrestrial Vascular Plants Developed by the Department of Botany and Microbiology, University of Oklahoma, in cooperation with EPA.

Reed, P.B., Jr. 1988. *National List of Plant Species that Occur in Wetlands: Southeast (Region II)*. U.S. Fish and Wildlife Service Biological Report 88(26.2).

Reuber, M.D. 1980. Significant of Acute and Chronic Renal Disease in Osborne-Mendel Rats Ingesting Dieldrin or Aldrin. *Clinic. Toxicol.* 17(2):159-170.

Rigdon, R.H., J. Neal. 1965. Effects of Feeding Benzo(a)pyrene on Fertility, Embryos, and Young Mice. *JNCI* 34:297-305.

RTECS, (Registry of Toxic Effects of Chemical Substances). 1993. Computerized Database Produced by the National Library of Medicine, Interactive Version of the National Institute of Occupational Safety and Health (NIOSH) Publication.

Schlicker, S.A. and D. H. Cox. 1968. Maternal Dietary Zinc, and Development and Zinc, Iron and Copper Content of the Rat Fetus. *J. Nutr.* 95:287-294.

Schmahl, D. 1955. Testing of naphthalene and anthracene as carcinogenic agents in the rat. *Krebsforsch.* 60:697-710. As cited in IRIS, 1996.

Schroeder, H.A. and J.J. Balassa. 1967. Arsenic, Germanium, Tin and Vanadium in Mice: Effects on Growth, Survival and Tissue Levels. *J. Nutr.* 92:245-252.

Schroeder, H.A. and M. Mitchener. 1971. Toxic Effects of Trace Elements on the Reproduction of Mice and Rats. *Arch. Envir. Health* 23:102-106.

Shacklette, H.T. and J.G. Boerngen. 1984. *Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States*. U.S. Geol. Surv. Prof. Paper 1270.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 8
Revision: 1
Date: April 1999

Skoryna, S.C. and M. Fuskova. 1981. Effects of Stable Strontium Supplementation. In: *Handbook of Stable Strontium*. S.C. Skornya (Ed.), Plenum Press.

Suter, G.W. 1993. *Ecological Risk Assessment*. Lewis Publishers, Chelsea, MI.

Suter, G.W. 1990. Endpoints for Regional Risk Assessments. *Envir. Manage.* 14:9-23.

Suter, G.W. 1989. Ecological Endpoints. In W. Warren-Hicks, B.R. Parkhurst, and S.S. Baker, Jr. (eds.). *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference Document*. EPA 600/3-89/013.

Terres, J.K. 1991. *The Audubon Society Encyclopedia of North American Birds*. Wings Books, New York, NY.

Thompson, A.R. 1973. Pesticide Residues in Soil Invertebrates. In: C.A. Edwards (ed.) *Environmental Pollution by Pesticides*. Plenum Press, New York, NY pp. 87-133.

Treon, J.F., F.P. Cleveland, and J. Cappel. 1955. Toxicity of Endrin for Laboratory Animals. *Agricultural and Food Chemistry* 3:842-848.

Tucker, R.K. and D.G. Crabtree. 1970. *Handbook of Toxicity of Pesticides to Wildlife* USDOI, FWS. Resource Publication No. 84.

Tyl, R.W., et al. 1988. Developmental Toxicity Evaluation of Dietary Di(2-ethylhexyl) phthalate in Fischer 344 Rats and CD-1 Mice. *Fundam. Appl. Toxicol.* 10:395-412.

Van Velsen, F.L., L.H.J.C. Danse, F.X.R. Van Leeuwen, J.A.M.A. Dormans, and M.J. Van Logten. 1986. The Subchronic Oral Toxicity of the B-isomer of Hexachlorocyclohexane in Rats. *Fund. Appl. Toxicol.* 6:697-712.8

Verschueren, K. 1983. *Handbook of Environmental Data on Organic Chemicals*. 2nd Edition. Van Nostrand Reinhold Co., New York, NY.

Virgo, B.B., and G.D. Bellward. 1975. Effects of Dietary Dieldrin on Reproduction in the Swiss-Vancouver (SWV) Mouse. *Envir. Physiol. Biochem.* 5:440-450.

Vohra, P. and F.H. Kratzer. 1968. Zinc, Copper, and Manganese Toxicities in Turkey Poults and their Alleviation by EDTA. *Poult. Sci.* 47:699-703.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 8
Revision: 1
Date: April 1999

Walker, F. 1971. Experimental Argyria: A Model for Basement Membrane Studies. *Brit. J. Exp. Path.* 52(6):589-593.

Wallace, A., J.W. Cha, and R.T. Mueller. 1977. "Cyanide Effects on Transport of Trace Metals in Plants." *Commun. In Soil Science and Plant Analysis* 8(9):709-712.

Weber, C.W. and B.L. Reid. 1968. Nickel Toxicity in Growing Chicks. *J. Nutr.* 95:612-616.

Weil, C.S. and D.D. McCollister. 1963. Relationship Between Short- and Long-Term Feeding Studies in Designing an Effective Toxicity Test. *Agric. Food Chem.* 11:486-491. (as cited in Lewis et al., 1990)

WESTON. 1994. *Field Sampling and Analysis Plan, Ecological Investigation, Tennessee Products CERCLA Site, Chattanooga, Tennessee.* Prepared for EPA Region 4.

Wheatley, G.A. and J.A. Hardman. 1968. Organochlorine Insecticide Residues in Earthworms from Arable Soils. *J. Sci. Fd. Agric.* 19:219-225.

White, P.S. 1982. "The Flora of the Great Smoky Mountains National Park: An Annotated Checklist of the Vascular Plants and a Review of Previous Floristic Work". U.S. Department of Interior, National Park Service, Southeast Region Research/Resource Management Report, SER-55.

White, D.H. and M.T. Finley. 1978. Uptake and Retention of Dietary Cadmium in Mallard Ducks. *Envir. Res.* 17:53-59.

Whitworth, M.R., et al. 1991. Effects of Boron and Arsenic on the Behavior of Mallard Ducklings. *Envir. Toxicol. Cont.* 10(7):911-916.

Wiemeyer, S.N., E.F. Hill, J.W. Carpenter, and A.J. Krynitsky. 1986. "Acute Oral Toxicity of Sodium Cyanide in Birds." *J. Wildl. Diseases.* 22(4):538-546.

Wildlife International Ltd. 1985. A Dietary LC₅₀ Study in the Bobwhite with Naphthalene. Wildlife International Ltd. Project No.:190-105. Submitted to W.A. Landis Associate, Inc.

Will, M.E. and G.W. Suter. 1994. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision.* ES/ER/TM-85/RI. Oak Ridge National Laboratory.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Section 8
Revision: 1
Date: April 1999

Wolff, J.O. 1985. Comparative Population Ecology of *Peromyscus leucopus* and *Peromyscus maniculatus*. *Can. J. Zool.* 63:1548-1555.

Wood, D.L. and J. Bitman. 1980. The Effect of Feeding Di(2-ethylhexyl)phthalate (DEHP) on the Lipid Metabolism of Laying Hens. *Lipids* 15(3):151-156.

Young, H. 1951. Territorial Behavior of the Eastern Robin. *Proceedings of the Linnean Society of New York*, 58-62:1-37.

Zoecon Corporation. 1983. MRID No. 00128356. Address FOI, EPA, Washington DC. 20460 as cited in IRIS, 1993.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Appendix A
Revision: 0
Date: April 1996

APPENDIX A

ENVIRONMENTAL MEDIA DATA

Table A-1
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Tar Dump
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	SC-1U TP1-H001 0-6"	SC-1M TP1-H002 7-12"	SC-1L TP1-H003 13-24"	SC-2U TP2-H001 0-6"	SC-2M TP2-H002 7-12"	SC-2L TP2-H003 13-24"	SC-3U TP3-H001 0-6"
<i>Organics</i>							
Acetone	1.40E+01 UJ	1.30E+01 U	1.20E+04 U	1.30E+01 UJ	1.40E+01 UJ	6.00E+01 U	1.40E+01 U
Aldrin	4.70E+01 U	5.80E+00 U	9.00E+00 U	5.00E+01 U	2.00E+01 U	6.10E+00 U	2.40E+01 U
alpha - BHC	2.10E+02	3.10E+02	4.70E+00 U	2.60E+02	9.20E+01	6.10E+00 U	8.50E+02
beta-BHC	3.70E+02	3.10E+02	6.80E+01	2.70E+02	1.30E+02	1.20E+01 UR	4.50E+02
delta-BHC	1.20E+02 UR	1.20E+02	4.20E+01 UR	1.00E+02 UR	5.00E+01 UR	6.10E+00 U	2.30E+02
gamma-BHC	6.50E+01	9.40E+01	2.10E+01	6.80E+01	3.30E+01	6.10E+00 U	2.90E+02
Carbazole	2.10E+02 J	1.60E+02 J	9.00E+02 U	1.60E+02 J	8.70E+02 U	3.90E+02 U	2.70E+02 J
alpha-Chlordane	7.00E+01 U	5.70E+01 UR	3.90E+01 UR	5.60E+01 UR	5.30E+01 UR	2.30E+01 UR	1.30E+02 U
gamma-Chlordane	4.70E+01 U	2.00E+01 UR	4.70E+00 U	2.20E+01 U	6.10E+00 U	6.10E+00 U	2.40E+01 U
DDD	9.20E+01 U	4.00E+01 U	9.00E+00 U	6.90E+01 UR	3.00E+01	1.20E+01 U	4.60E+01 U
DDT	9.20E+01 U	4.00E+01 U	2.00E+01 U	9.00E+01 U	4.00E+01 U	6.30E+00 UR	5.00E+01 U
Dibenzofuran	1.00E+03 U	1.90E+03 U	9.00E+02 U	8.60E+02 U	8.70E+02 U	3.90E+02 U	1.80E+03 U
Dieldrin	3.50E+03	1.70E+02	1.20E+02	1.50E+03	3.50E+02	1.80E+01	6.60E+02
Endosulfan I	7.20E+01	3.00E+01 U	9.00E+00 UR	5.70E+01 UR	5.50E+01 UR	2.40E+01 UR	1.00E+02
Endosulfan II	9.20E+01 U	2.90E+01	1.40E+01	5.70E+01	3.00E+01 U	1.20E+01 U	1.10E+02 U
Endrin	9.20E+01 U	2.00E+01 U	2.00E+01 U	1.60E+02 UR	5.30E+01 UR	1.20E+01 U	4.60E+01 U
Endrin aldehyde	9.20E+01 U	3.00E+01 U	2.00E+01 U	4.30E+01 U	3.00E+01 U	1.20E+01 U	8.70E+01
Heptachlor	9.80E+01 UR	5.80E+00 U	3.40E+01 UR	8.20E+01 UR	4.00E+01 UR	6.10E+00 U	2.90E+02
Heptachlor epoxide	4.70E+01 U	2.50E+01	1.00E+01 U	4.00E+01 U	2.00E+01 U	6.10E+00 U	4.70E+01
Hexachlorobenzene	3.80E+02 J	1.90E+03 U	9.00E+02 U	2.50E+02 J	8.70E+02 U	3.90E+02 U	2.60E+02 J
Methoxychlor	4.70E+02 U	5.80E+01 U	4.70E+01 U	2.20E+02 U	6.10E+01 U	6.10E+01 U	2.40E+02 U
2-Methylnaphthalene	1.00E+02 J	1.90E+03 U	9.00E+02 U	8.60E+02 U	8.70E+02 U	3.90E+02 U	1.80E+02 J
Naphthalene	2.10E+02 J	1.90E+03 U	9.00E+02 U	1.30E+02 J	8.70E+02 U	3.90E+02 U	3.70E+02 J
PAHs							
Acenaphthylene	6.60E+02 J	1.10E+03 J	2.40E+02 J	5.80E+02 J	3.80E+02 J	9.70E+01 J	2.10E+03
Anthracene	6.20E+02 J	5.90E+02 J	3.50E+02 J	5.70E+02 J	3.60E+02 J	1.60E+02 J	1.70E+03 J
Benzo(a)anthracene	3.70E+03	5.70E+03	3.70E+03	3.20E+03	3.50E+03	1.20E+03	1.30E+04
Benzo(a)pyrene	4.20E+03	7.30E+03	3.60E+03	3.60E+03	3.40E+03	1.20E+03	1.50E+04
Benzo(b and/or k)fluoranthene	8.30E+03	1.40E+04	7.30E+03	8.10E+03	7.10E+03	2.20E+03	3.80E+04
Benzo(g,h,i)perylene	2.30E+03	5.80E+03	2.10E+03	2.00E+03	1.80E+03	8.90E+02	8.60E+03
Chrysene	4.10E+03	6.50E+03	3.80E+03	3.60E+03	3.60E+03	1.30E+03	1.30E+04
Dibenzo(a,h)anthracene	1.00E+03 J	2.40E+03	9.80E+02	9.90E+02	8.70E+02	3.40E+02 J	5.40E+03
Fluoranthene	5.50E+03	7.60E+03	4.90E+03	4.80E+03	5.30E+03	2.20E+03	1.30E+04
Indeno(1,2,3-cd)pyrene	2.80E+03	6.70E+03	2.40E+03	2.50E+03	2.20E+03	9.10E+02	1.20E+04
Phenanthrene	1.20E+03	1.00E+03 J	9.60E+02	1.00E+03	9.20E+02	5.70E+02	2.40E+03

Table A-1 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Tar Dump
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	91916 SC-IU TP1-H001 0-6"	91923 SC-1M TP1-H002 7-12"	91920 SC-1L TP1-H003 13-24"	91922 SC-2U TP2-H001 0-6"	91925 SC-2M TP2-H002 7-12"	91924 SC-2L TP2-H003 13-24"	91950 SC-3U TP3-H001 0-6"
<i>Organics (continued)</i>							
Pyrene	4.00E+03	6.10E+03	3.70E+03	3.50E+03	3.80E+03	1.60E+03	1.40E+04
Tetrachloroethene	1.40E+01 UJ	2.00E+00 J	6.40E+01 U	2.00E+00 J	1.40E+01 UJ	1.30E+01 U	4.00E+00 J
1,1,1-Trichloroethane	1.40E+01 UJ	8.00E+00 J	6.40E+01 U	3.00E+00 J	1.40E+01 UJ	1.30E+01 U	1.40E+01 U
Trichloroethylene	1.40E+01 UJ	1.30E+01 U	6.40E+01 U	1.30E+01 UJ	1.40E+01 UJ	1.30E+01 U	1.40E+01 U
Xylenes (total)	1.40E+01 UJ	1.30E+01 U	6.40E+01 U	1.30E+01 UJ	1.40E+01 UJ	1.30E+01 U	1.40E+01 U
<i>Inorganics</i>							
Aluminum	1.00E+04	1.00E+04	9.60E+03	1.60E+03	1.00E+04	1.00E+04	1.30E+04 J
Arsenic	8.60E+00	8.60E+00	6.80E+00	8.60E+00	9.10E+00	1.40E+01	8.30E+00
Barium	1.30E+02	1.10E+02	9.50E+01	1.40E+02	1.00E+02	9.50E+01	1.40E+02
Beryllium	2.00E+00 U	2.00E+00 U	2.00E+00 U	2.00E+00 U	2.00E+00 U	1.40E+00	2.00E+00 U
Cadmium	1.00E+00 U	3.40E-01 U	3.40E-01 U	1.00E+00 U	1.00E+00 U	3.70E-01 U	1.00E+00 U
Calcium	1.70E+03	6.60E+02	9.10E+02	2.40E+03	1.40E+03	1.40E+03	2.90E+03 J
Chromium	1.70E+02	1.40E+02	6.80E+01	1.40E+02	1.00E+02	3.90E+01	9.80E+01 J
Cobalt	1.50E+01	1.80E+01	2.00E+01	1.60E+01	2.10E+01	2.40E+01	1.80E+01
Copper	4.00E+01 U	4.00E+01 U	4.00E+01 U	4.00E+01 U	3.00E+01 U	3.00E+01 U	5.90E+01
Iron	1.90E+04	1.90E+04	1.80E+04	2.00E+04	1.90E+04	1.80E+04	2.10E+04 J
Lead	9.50E+01 J	5.40E+01 J	4.10E+01 J	1.00E+02 J	4.50E+01 J	2.70E+01 J	1.30E+02
Magnesium	7.80E+02	6.50E+02	5.50E+02	8.90E+02	6.60E+02	6.30E+02	1.10E+03
Manganese	6.60E+02	8.00E+02	8.40E+02	7.90E+02	8.30E+02	8.90E+02	7.90E+02 J
Mercury	3.60E-01	4.40E-01	3.60E-01	4.30E-01	3.70E-01	3.10E-01	3.40E-01 J
Nickel	2.50E+01	2.20E+01	2.80E+01	2.60E+01	3.40E+01	3.80E+01	3.20E+01
Potassium	6.70E+02 U	6.10E+02 U	5.10E+02 U	7.90E+02 U	6.40E+02 U	6.00E+02 U	9.80E+02 U
Selenium	8.00E-01 U	1.00E+00 U	7.20E-01 U	8.50E-01 U	1.00E+00 U	8.00E-01 U	8.00E-01 U
Silver	2.80E+00 J	3.50E+00	3.00E+00 U	3.00E+00 U	3.00E+00 U	2.00E+00 U	2.70E+01
Vanadium	2.30E+01	2.20E+01	1.90E+01	2.40E+01	2.20E+01	2.10E+01	2.60E+01
Zinc	1.00E+02	1.10E+02	1.20E+02	2.00E+02	1.30E+02	1.10E+02	2.10E+02 J
Cyanide	6.70E-01 U	6.50E-01 U	6.00E-01 U	6.70E-01 U	6.40E-01 U	6.60E-01 U	6.90E-01 U

J = Chemical was identified but below the sample quantitation limit (SQL). Value presented was estimated.

U = Chemical was analyzed for, but not detected. Value represents the SQL.

UJ = Chemical was analyzed for, but not detected. The quantitation limit may be inaccurate or imprecise.

UR = Chemical was analyzed for, but not detected. Quality control indicated that the data are unusable.

Table A-1 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Tar Dump
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	SC-3M TP3-H002 7-12"	SC-3L TP3-H003 13-24"	SC-4U TP4-H001 0-6"	SC-11U TP4-H101 0-6"	SC-4M TP4-H002 7-12"	SC-11M TP4-H102 7-12"	SC-4L TP4-H003 13-24"
<i>Organics</i>							
Acetone	9.60E+02 J	1.30E+01 UJ	3.00E+01 U	1.40E+01 U	4.00E+04 J	2.30E+04	4.70E+04 J
Aldrin	9.10E+01 U	4.40E+00 U	2.50E+01 U	4.80E+01 U	4.50E+01 U	9.00E+01 U	6.50E+00 U
alpha - BHC	3.60E+03	3.00E+02 U	5.50E+02 U	8.00E+02	6.40E+02 U	7.70E+02	8.00E+00 U
beta-BHC	1.30E+03	1.20E+02	3.50E+02	3.70E+02	5.00E+02	4.70E+02	6.50E+00 U
delta-BHC	5.10E+02	3.70E+01	2.00E+02	2.60E+02	2.40E+02	3.20E+02 UR	2.70E+00 J
gamma-BHC	1.10E+03	6.50E+01	1.90E+02	2.80E+02	1.80E+02	2.20E+02	6.50E+00 U
Carbazole	4.40E+02 J	2.10E+03 U	8.20E+01 J	2.20E+02 J	1.20E+02 J	4.40E+02 J	6.90E+02 U
alpha-Chlordane	3.70E+02 U	4.40E+00 U	2.50E+01 U	4.80E+01 U	1.30E+02 U	2.40E+02 UR	6.50E+00 U
gamma-Chlordane	9.10E+01 U	4.40E+00 U	2.50E+01 U	4.80E+01 U	4.50E+01 U	1.20E+02 UR	6.50E+00 U
DDD	1.10E+02 UR	8.50E+00 U	4.80E+01 U	9.30E+01 U	8.80E+01 U	1.70E+02 UR	1.30E+01 U
DDT	1.80E+02 U	2.00E+01 U	7.00E+01 U	9.30E+01 U	8.80E+01 U	1.20E+02 U	1.30E+01 U
Dibenzofuran	3.50E+03 U	2.10E+03 U	5.60E+02 U	2.20E+03 U	1.00E+02 J	2.40E+03 U	6.90E+02 U
Dieldrin	9.10E+02	1.10E+02	3.10E+03	2.30E+03	2.80E+02	5.60E+02	1.30E+01
Endosulfan I	1.20E+02 U	5.70E+01	7.00E+01 U	8.00E+01 U	1.00E+02 U	1.10E+02 UR	9.00E+00 UR
Endosulfan II	9.40E+01 UR	1.00E+01 U	7.00E+01 U	9.10E+01 J	8.80E+01 U	1.20E+02	1.30E+01 U
Endrin	1.80E+02 U	8.50E+00 U	5.00E+01 U	9.30E+01 U	8.80E+01 U	1.90E+02 UR	1.30E+01 U
Endrin aldehyde	1.80E+02 U	8.50E+00 U	4.80E+01 U	9.30E+01 U	8.80E+01 U	1.30E+02 U	1.30E+01 U
Heptachlor	9.10E+01 U	4.00E+01 U	3.00E+02	3.60E+02 U	4.50E+01 U	1.50E+02 UR	5.40E+00 UR
Heptachlor epoxide	1.60E+02	8.00E+00 U	4.00E+01 U	8.80E+01	9.00E+01 U	1.00E+02 U	6.50E+00 U
Hexachlorobenzene	3.50E+03 U	2.10E+03 U	7.20E+01 J	4.60E+02 J	8.70E+02 U	2.40E+03 U	6.90E+02 U
Methoxychlor	9.10E+02 U	2.10E+02 U	2.50E+02 U	4.80E+02 U	4.50E+02 U	4.70E+02 U	6.50E+01
2-Methylnaphthalene	3.50E+03 U	2.10E+03 U	9.20E+01 J	2.20E+03 U	1.40E+02 J	2.40E+03 U	6.90E+02 U
Naphthalene	4.60E+02 J	3.10E+02 J	1.60E+02 J	2.80E+02 J	2.20E+02 J	3.40E+02 J	8.30E+01 J
PAHs							
Acenaphthylene	4.50E+03	6.90E+02 J	3.20E+02 J	8.70E+02 J	1.10E+03	1.70E+03 J	2.10E+02 J
Anthracene	3.50E+03	1.20E+03 J	5.60E+02 U	6.90E+02 J	1.20E+03	1.50E+03 J	3.80E+02 J
Benzo(a)anthracene	3.80E+04	1.10E+04	2.10E+03	5.60E+03	4.40E+03	9.90E+03	2.30E+03
Benzo(a)pyrene	5.00E+04	1.00E+04	5.20E+02 J	7.20E+03	8.70E+02 U	1.20E+04	2.30E+03
Benzo(b and/or k)fluoranthene	9.80E+04	2.00E+04	4.90E+03	1.40E+04	7.80E+03	2.20E+04	4.80E+03
Benzo(g,h,i)perylene	2.20E+04	3.40E+03	5.60E+02 U	3.50E+03	8.70E+02 U	6.70E+03	5.80E+02 J
Chrysene	4.00E+04	1.10E+04	2.00E+03	6.20E+03	3.30E+03	1.10E+04	2.50E+03
Dibenzo(a,h)anthracene	1.20E+04	2.60E+03	6.10E+02	2.10E+03 J	1.40E+03	3.10E+03	6.40E+02 J
Fluoranthene	4.60E+04	1.40E+04	3.00E+03	6.30E+03	4.40E+03	1.40E+04	3.30E+03
Indeno(1,2,3-cd)pyrene	2.70E+04	7.40E+03	5.60E+02	5.60E+03	8.70E+02 J	8.60E+03	1.70E+03
Phenanthrene	7.40E+03	3.20E+03	6.30E+02	1.40E+03 J	9.20E+02	3.20E+03	8.20E+02

Table A-1 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Tar Dump
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	91951 SC-3M TP3-H002 7-12"	91965 SC-3L TP3-H003 13-24"	91960 SC-4U TP4-H001 0-6"	91910 SC-11U TP4-H101 0-6"	91958 SC-4M TP4-H002 7-12"	91912 SC-11M TP4-H102 7-12"	91964 SC-4L TP4-H003 13-24"
<i>Organics (continued)</i>							
Pyrene	4.20E+04	1.10E+04	1.00E+03	6.40E+03	1.10E+03	1.00E+04	2.70E+03
Tetrachloroethene	3.00E+00 J	1.30E+01 UJ	1.40E+01 UJ	1.40E+01 U	1.60E+03 UJ	1.60E+03 U	1.50E+03 UJ
1,1,1-Trichloroethane	1.40E+01 U	1.30E+01 UJ	1.40E+01 UJ	1.40E+01 U	1.60E+03 UJ	1.60E+03 U	1.50E+03 UJ
Trichloroethylene	1.40E+01 U	1.30E+01 UJ	1.40E+01 UJ	1.40E+01 U	1.60E+03 UJ	1.60E+03 U	1.50E+03 UJ
Xylenes (total)	1.40E+01 U	1.30E+01 UJ	1.40E+01 UJ	1.40E+01 U	1.60E+03 UJ	1.60E+03 U	1.50E+03 UJ
<i>Inorganics</i>							
Aluminum	1.20E+04 J	1.20E+04	1.10E+04	1.20E+04	9.10E+03	1.00E+04	1.10E+04
Arsenic	1.40E+01	9.50E+00	9.50E+00	9.50E+00	1.00E+01	1.20E+01	6.10E+00
Barium	1.50E+02	1.00E+02	1.40E+02	1.40E+02	1.20E+02	1.40E+02 U	9.90E+01
Beryllium	2.00E+00 U	1.00E+00 U	2.00E+00 U	2.00E+00 U	1.00E+00 U	2.00E+00 U	1.00E+00 U
Cadmium	1.00E+00 U	1.00E+00 U	1.00E+00 U	1.00E+00 U	1.00E+00 U	3.70E-01	1.00E+00 U
Calcium	1.70E+03 J	1.40E+03 J	2.20E+03 J	2.30E+03	8.10E+02 J	1.00E+03	9.40E+02 J
Chromium	3.60E+02 J	7.90E+01	1.50E+02	1.10E+02	1.60E+02	2.10E+02	3.00E+01
Cobalt	1.60E+01	1.90E+01	1.50E+01	1.60E+01	1.60E+01	1.60E+01	1.20E+01
Copper	5.80E+01	4.00E+01 U	5.00E+01 U	5.00E+01 U	5.00E+01	5.00E+01 U	2.00E+01 U
Iron	2.10E+04 J	2.00E+04	2.00E+04	2.00E+04	1.70E+04	1.90E+04	1.70E+03
Lead	7.20E+01	4.30E+01	1.10E+02	1.20E+02 J	5.20E+01	6.80E+01 J	2.10E+01
Magnesium	8.60E+02	7.80E+02	8.50E+02	9.50E+02	5.70E+02	6.80E+02	7.70E+02
Manganese	6.30E+02 J	7.00E+02	7.10E+02	7.50E+02	6.40E+02	6.60E+02	8.70E+02
Mercury	5.90E-01 J	3.70E-01 J	5.10E-01 J	7.90E-01	3.80E-01 J	4.30E-01	2.00E-01 UJ
Nickel	3.60E+01	3.50E+01	2.50E+01	2.70E+01	1.90E+01	2.20E+01	2.00E+01
Potassium	7.70E+02 U	7.90E+02 U	8.50E+02 U	1.10E+03 U	5.90E+02 U	6.90E+02 U	7.50E+02
Selenium	1.00E+00 U	1.60E+00 J	2.00E+00 U	8.20E-01 U	1.40E+00 J	8.00E-01 U	7.10E-01 U
Silver	2.00E+00 U	8.60E-01 U	1.00E+00 U	2.00E+00 U	8.90E-01 U	3.00E+00 U	8.30E-01 U
Vanadium	2.50E+01	2.20E+01	2.40E+01	2.60E+01	2.00E+01	2.20E+01	2.00E+01
Zinc	2.00E+02 J	1.60E+02	2.10E+02	2.00E+02	1.30E+02	1.40E+02	9.90E+01
Cyanide	7.80E-01	6.30E-01 U	7.40E-01 U	6.80E-01 U	6.50E-01 U	7.10E-01 U	5.80E-01 U

J = Chemical was identified but below the sample quantitation limit (SQL). Value presented was estimated.

U = Chemical was analyzed for, but not detected. Value represents the SQL.

UJ = Chemical was analyzed for, but not detected. The quantitation limit may be inaccurate or imprecise.

UR = Chemical was analyzed for, but not detected. Quality control indicated that the data are unusable.

Table A-1 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Tar Dump
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	SC-11L TP4-H103 13-24"	SC-5U TP5-H001 0-6"	SC-5M TP5-H002 7-12"	SC-5L TP5-H003 13-24"	SC-6U TP6-H001 0-6"	SC-6M TP6-H002 7-12"	SC-6L TP6-H003 13-24"
<i>Organics</i>							
Acetone	5.90E+02 J	9.00E+04	2.40E+04 J	1.40E+04	1.40E+01 U	1.20E+03 U	5.40E+03 U
Aldrin	6.50E+00 U	4.20E+00 U	4.00E+00 U	4.00E+00 U	6.00E+01 U	4.00E+01 U	2.80E+00
alpha - BHC	2.00E+01 U	3.50E+01	2.00E+01 U	2.00E+01 U	4.80E+01 U	3.50E+02	2.20E+00 U
beta-BHC	3.90E+01	1.90E+01	1.00E+01	1.10E+01 UR	3.70E+02	5.10E+02	7.00E+00
delta-BHC	8.00E+00 U	1.20E+01	5.70E+00 UR	5.50E+00	1.50E+02 U	1.80E+02 UR	2.20E+00 U
gamma-BHC	4.60E+00 J	8.80E+00	4.40E+00 UR	3.80E+00 J	7.60E+01	1.60E+02	2.20E+00 U
Carbazole	1.20E+02 J	4.00E+02 U	3.90E+02 U	3.90E+02 U	4.60E+03 U	1.30E+02 J	7.70E+01 J
alpha-Chlordane	3.60E+01	6.00E+00 U	4.00E+00 U	5.00E+00 U	9.00E+01 U	1.20E+02 UR	2.10E+01 UR
gamma-Chlordane	6.50E+00 U	4.20E+00 U	4.00E+00 U	4.00E+00 U	9.00E+01	1.80E+01 U	2.20E+00 U
DDD	1.30E+01 U	8.10E+00 U	7.90E+00 U	7.90E+00 U	1.10E+02 U	4.00E+01 U	4.30E+00 U
DDT	7.80E+00 J	8.10E+00 U	7.90E+00 U	7.90E+00 U	1.20E+02 U	6.00E+01 U	4.30E+00 U
Dibenzofuran	1.20E+03 U	4.00E+02 U	3.90E+02 U	3.90E+02 U	4.60E+03 U	1.20E+03 U	4.30E+02 U
Dieldrin	4.20E+01	8.10E+00 U	8.00E+00	2.50E+01	3.90E+03	2.80E+02 U	1.10E+01
Endosulfan I	6.50E+00 U	4.20E+00 U	4.00E+00 U	4.00E+00 U	7.00E+01 U	5.40E+01 UR	2.10E+01 UR
Endosulfan II	7.00E+00 J	8.10E+00 U	7.90E+00 U	7.90E+00 U	1.10E+02	6.00E+01	4.30E+00 U
Endrin	1.30E+01 U	8.10E+00 U	7.90E+00 U	7.90E+00 U	9.30E+01 U	8.60E+01 UR	4.30E+00 U
Endrin aldehyde	3.00E+01 U	8.10E+00 U	7.90E+00 U	7.90E+00 U	9.30E+01 U	6.00E+01 U	4.30E+00 U
Heptachlor	6.50E+00 U	4.20E+00 U	4.00E+00 U	4.00E+00 U	1.50E+02	1.70E+02 UR	1.70E+00 UR
Heptachlor epoxide	6.50E+00 U	4.20E+00 U	4.00E+00 U	4.00E+00 U	7.30E+01	6.00E+01 U	6.00E+00 U
Hexachlorobenzene	1.20E+03 U	4.00E+02 U	3.90E+02 U	3.90E+02 U	5.80E+02 J	1.20E+03 U	4.30E+02 U
Methoxychlor	6.50E+01 U	4.20E+01 U	4.00E+01 U	4.00E+01 U	4.80E+02 U	1.80E+02 U	2.20E+01 U
2-Methylnaphthalene	1.20E+03 U	4.00E+02 U	3.90E+02 U	3.90E+02 U	4.60E+03 U	1.20E+03 U	4.30E+02 U
Naphthalene	1.20E+03 U	4.00E+02 U	3.90E+02 U	3.90E+02 U	4.60E+03 U	1.20E+03 U	7.20E+01 J
PAHs							
Acenaphthylene	5.90E+02 J	4.00E+02 U	6.90E+01 J	3.90E+02 U	5.40E+02 J	7.80E+02 J	1.90E+02 J
Anthracene	5.30E+02 J	4.10E+01 J	7.00E+01 J	3.90E+02 U	5.70E+02 J	5.90E+02 J	3.40E+02 J
Benzo(a)anthracene	4.60E+03	3.60E+02 J	6.70E+02	3.60E+02 J	3.90E+03 J	5.70E+03	3.10E+03
Benzo(a)pyrene	4.80E+03	4.40E+02	6.10E+02	4.20E+02	5.20E+03	6.20E+03	2.80E+03
Benzo(b and/or k)fluoranthene	9.40E+03	9.00E+02 J	1.60E+03	8.90E+02	1.10E+04	1.20E+04	5.70E+03
Benzo(g,h,i)perylene	2.60E+03	4.50E+02	3.90E+02 U	3.90E+02 U	2.80E+03 J	3.00E+03	1.40E+03
Chrysene	4.80E+03	4.60E+02	8.00E+02	4.30E+02	4.90E+03	6.10E+03	3.00E+03
Dibenzo(a,h)anthracene	1.30E+03	1.20E+02 J	1.90E+02 J	1.10E+02 J	4.60E+03 U	1.60E+03	7.50E+02
Fluoranthene	6.40E+03	4.70E+02	7.90E+02	4.70E+02	5.30E+03	6.90E+03	5.40E+03
Indeno(1,2,3-cd)pyrene	3.30E+03	3.10E+02 J	5.30E+02	3.00E+02 J	3.70E+03 J	4.40E+03	1.90E+03
Phenanthrene	1.20E+03 J	8.30E+01 J	1.40E+02 J	1.00E+02 J	1.20E+03 J	1.10E+03 J	1.10E+03

Table A-1 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Tar Dump
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	91915 SC-11L TP4-H103 13-24"	91913 SC-5U TP5-H001 0-6"	91963 SC-5M TP5-H002 7-12"	91909 SC-5L TP5-H003 13-24"	91914 SC-6U TP6-H001 0-6"	91918 SC-6M TP6-H002 7-12"	91911 SC-6L TP6-H003 13-24"
<i>Organics (continued)</i>							
Pyrene	4.70E+03	4.10E+02	6.90E+02	3.80E+02 J	4.60E+03 J	5.40E+03	3.40E+03
Tetrachloroethene	1.30E+01 U	1.50E+03 U	6.00E+01 U	1.40E+03 U	3.00E+00 J	6.60E+01 U	6.60E+01 U
1,1,1-Trichloroethane	1.30E+01 U	1.50E+03 U	6.00E+01 U	1.40E+03 U	1.40E+01 U	6.60E+01 U	6.60E+01 U
Trichloroethylene	1.30E+01 U	1.50E+03 U	6.00E+01 U	1.40E+03 U	1.40E+01 U	6.60E+01 U	6.60E+01 U
Xylenes (total)	1.30E+01 U	1.50E+03 U	6.00E+01 U	1.40E+03 U	1.40E+01 U	6.60E+01 U	6.60E+01 U
<i>Inorganics</i>							
Aluminum	8.90E+03	9.20E+03	1.10E+04	1.30E+04	1.00E+04	1.10E+04	1.10E+04
Arsenic	6.90E+00	4.90E+00	3.60E+00	4.00E+00	8.30E+00	9.50E+00	9.80E+00
Barium	1.00E+02	8.50E+01	9.20E+01	1.00E+02	1.40E+02	1.10E+02	9.50E+01
Beryllium	1.00E+00 U	1.00E+00 U	1.00E+00 U	2.00E+00 U	2.00E+00 U	2.00E+00 U	1.30E+00
Cadmium	3.30E-01 U	3.10E-01 U	2.00E-01 U	3.20E-01	1.00E+00 U	3.40E-01 U	3.50E-01 U
Calcium	8.80E+02	1.40E+03	1.20E+03 J	1.20E+03	2.70E+03	1.00E+03	9.50E+02
Chromium	9.20E+01	1.80E+01	1.70E+01	2.30E+01	1.30E+02	1.30E+02	4.10E+01
Cobalt	1.60E+01	1.10E+01	7.00E+00 U	8.00E+00 U	1.50E+01	1.80E+01	2.30E+01
Copper	3.00E+01 U	2.00E+01 U	2.00E+01 U	2.00E+01 U	4.00E+01 U	4.00E+01 U	3.00E+01 U
Iron	1.60E+04	1.60E+04	1.40E+04	1.60E+04	2.00E+04	2.00E+04	1.80E+04
Lead	3.60E+01 J	2.60E+01 J	1.00E+01	1.70E+01 J	1.30E+02 J	5.20E+01 J	3.00E+01 J
Magnesium	5.40E+02	6.30E+02	6.90E+02	8.10E+02	8.40E+02	6.30E+02	5.90E+02
Manganese	8.00E+02	9.00E+02	5.20E+02	3.30E+02	7.90E+02	7.40E+02	8.10E+02
Mercury	3.50E-01	7.00E-02 U	6.00E-02 U	6.00E-02 U	4.10E-01	5.20E-01	3.00E-01
Nickel	1.90E+01	1.20E+01	1.20E+01	1.20E+01	2.70E+01	2.60E+01	4.10E+01
Potassium	5.60E+02 U	4.40E+02 U	5.40E+02 U	6.30E+02 U	7.80E+02 U	6.50E+02 U	5.90E+02 U
Selenium	1.00E+00 U	6.70E-01 U	6.60E-01 U	6.90E-01 U	8.00E-01 U	9.30E-01 J	2.00E+00 U
Silver	2.00E+00 U	2.00E+00 U	7.70E-01 U	2.00E+00 U	3.00E+00 U	2.00E+00 U	2.00E+00 U
Vanadium	1.80E+01	1.70E+01	1.70E+01	2.00E+01	2.40E+01	2.10E+01	2.10E+01
Zinc	9.20E+01	5.20E+01	4.10E+01	4.80E+01	2.20E+02	1.30E+02	1.50E+02
Cyanide	6.50E-01 U	5.80E-01 U	5.50E-01 U	5.50E-01 U	6.40E-01 U	6.50E-01 U	6.30E-01 U

J = Chemical was identified but below the sample quantitation limit (SQL). Value presented was estimated.

U = Chemical was analyzed for, but not detected. Value represents the SQL.

UJ = Chemical was analyzed for, but not detected. The quantitation limit may be inaccurate or imprecise.

UR = Chemical was analyzed for, but not detected. Quality control indicated that the data are unusable.

Table A-1 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Tar Dump
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	SC-7U TP7-H001 0-6"	SC-7M TP7-H002 7-12"	SC-7L TP7-H003 13-24"	SC-8U TP8-H001 0-6"	SC-8M TP8-H002 7-12"	SC-8L TP8-H003 13-24"	SC-9U TP9-H001 0-6"
<i>Organics</i>							
Acetone	1.50E+04 J	1.20E+01 U	1.20E+01 U	1.20E+01 U	9.10E+03 U	1.20E+01 U	2.00E+01 U
Aldrin	1.00E+01 U	6.00E+00 U	6.00E+00 U	1.00E+01 U	4.00E+00 U	1.40E+01 U	1.00E+01 U
alpha - BHC	1.10E+02 U	2.40E+02 U	5.00E+01 U	1.30E+02 U	2.70E+02 U	1.00E+02	1.20E+02 UR
beta-BHC	4.50E+01	1.20E+02 UR	2.40E+01 UR	9.00E+01	1.10E+02 UR	8.00E+01 UR	4.40E+01 UR
delta-BHC	1.90E+01 UR	5.80E+01	8.40E+00 UR	3.20E+01 UR	5.00E+01 UR	3.20E+01 UR	1.90E+01
gamma-BHC	2.50E+01	5.50E+01	2.00E+01 U	4.80E+01	6.60E+01	2.70E+01	2.70E+01
Carbazole	4.10E+02 U	6.40E+02 U	3.80E+02 U	3.90E+02 U	3.90E+02 U	5.40E+02 U	4.00E+02 U
alpha-Chlordane	2.00E+01 U	2.00E+01 U	6.00E+00 U	2.00E+01 U	4.00E+00 U	2.00E+01 U	1.00E+01 U
gamma-Chlordane	1.00E+01 U	4.00E+00 U	6.00E+00 U	1.00E+01 U	4.00E+00 U	1.40E+01 U	1.00E+01 U
DDD	2.00E+01 U	7.70E+00 U	1.20E+01 U	2.00E+01 U	7.90E+00 U	2.70E+01 U	2.00E+01 U
DDT	2.00E+01 U	7.70E+00 U	1.20E+01 U	2.00E+01 U	2.00E+01 U	2.70E+01 U	2.00E+01 U
Dibenzofuran	4.10E+02 U	6.40E+02 U	3.80E+02 U	3.90E+02 U	3.90E+02 U	5.40E+02 U	4.00E+02 U
Dieldrin	2.00E+01 U	5.50E+01	1.30E+01	2.00E+01 U	9.00E+01	5.30E+01	1.10E+01 J
Endosulfan I	1.00E+01 U	1.80E+01	6.00E+00 U	1.00E+01 U	2.20E+01	1.40E+01 U	1.00E+01 U
Endosulfan II	2.00E+01 U	7.70E+00 U	1.20E+01 U	2.00E+01 U	1.70E+01 UR	2.70E+01 U	2.00E+01 U
Endrin	2.00E+01 U	7.70E+00 U	1.20E+01 U	2.00E+01 U	7.90E+00 U	2.70E+01 U	2.00E+01 U
Endrin aldehyde	2.00E+01 U	7.70E+00 U	1.20E+01 U	2.00E+01 U	1.00E+01 UR	2.70E+01 U	2.00E+01 U
Heptachlor	2.00E+01 U	5.00E+00 U	6.00E+00 U	4.30E+01	5.00E+01 U	2.50E+01 UR	1.00E+01 U
Heptachlor epoxide	1.00E+01 U	9.80E+00	6.00E+00 U	6.90E+00 J	1.30E+01	1.40E+01 U	1.00E+01 U
Hexachlorobenzene	4.10E+02 U	6.40E+02 U	3.80E+02 U	3.90E+02 U	3.90E+02 U	5.40E+02 U	4.00E+02 U
Methoxychlor	1.00E+02 U	4.00E+01 U	6.00E+01 U	1.00E+02 U	2.00E+01 J	1.40E+02 U	1.00E+02 U
2-Methylnaphthalene	4.10E+02 U	6.40E+02 U	3.80E+02 U	3.90E+02 U	3.90E+02 U	5.40E+02 U	4.00E+02 U
Naphthalene	4.10E+02 U	7.00E+01 J	3.80E+02 U	3.90E+02 U	3.90E+02 U	5.40E+02 U	4.00E+02 U
<i>PAHs</i>							
Acenaphthylene	8.30E+01 J	3.40E+02 J	6.50E+01 J	1.10E+02 J	1.60E+02 J	5.40E+02 U	7.10E+01 J
Anthracene	6.00E+01 J	3.30E+02 J	3.90E+01 J	1.20E+02 J	1.30E+02 J	5.40E+02 U	8.20E+01 J
Benzo(a)anthracene	7.00E+02	2.40E+03	2.30E+02 J	9.90E+02	1.20E+03	4.50E+02 J	7.70E+02
Benzo(a)pyrene	8.50E+02	2.70E+03	3.80E+02 U	1.20E+03	1.40E+03	6.00E+02	1.00E+03
Benzo(b and/or k)fluoranthene	1.90E+03	5.80E+03	3.00E+02 J	2.40E+03	2.90E+03	1.20E+03	2.30E+03
Benzo(g,h,i)perylene	4.50E+02	1.80E+03	3.80E+02 U	1.10E+03	8.10E+02	4.60E+02 J	6.40E+02
Chrysene	7.60E+02	2.60E+03	1.60E+02 J	1.10E+03	1.30E+03	5.60E+02	9.50E+02
Dibenzo(a,h)anthracene	1.90E+02 J	7.60E+02	3.80E+02 U	3.00E+02 J	3.60E+02 J	1.60E+02 J	3.00E+02 J
Fluoranthene	9.10E+02	3.40E+03	2.50E+02 J	1.20E+03	1.40E+03	5.70E+02	8.80E+02
Indeno(1,2,3-cd)pyrene	5.60E+02	2.10E+03	3.80E+02 U	8.80E+02	9.60E+02	4.30E+02 J	8.30E+02
Phenanthrene	1.30E+02 J	6.80E+02	3.90E+01 J	2.90E+02 J	1.70E+02 J	7.20E+01 J	1.10E+02 J

Table A-1 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Tar Dump
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	91949 SC-7U TP7-H001 0-6"	91956 SC-7M TP7-H002 7-12"	91957 SC-7L TP7-H003 13-24"	91954 SC-8U TP8-H001 0-6"	91948 SC-8M TP8-H002 7-12"	91917 SC-8L TP8-H003 13-24"	91953 SC-9U TP9-H001 0-6"
<i>Organics (continued)</i>							
Pyrene	7.90E+02	2.40E+03	3.80E+02 U	1.30E+03	1.20E+03	5.20E+02 J	8.50E+02
Tetrachloroethene	1.40E+03 U	1.20E+01 U	1.20E+01 U	1.20E+01 UJ	1.40E+03 U	1.20E+01 U	1.20E+01 U
1,1,1-Trichloroethane	1.40E+03 U	1.20E+01 U	1.20E+01 U	2.00E+00 J	1.40E+03 U	1.20E+01 U	1.20E+01 U
Trichloroethylene	1.40E+03 U	1.20E+01 U	1.20E+01 U	2.00E+00 J	1.40E+03 U	1.20E+01 U	1.20E+01 U
Xylenes (total)	1.40E+03 U	1.20E+01 U	1.20E+01 U	1.20E+01 UJ	1.40E+03 U	1.20E+01 U	1.20E+01 U
<i>Inorganics</i>							
Aluminum	1.10E+04 J	1.20E+04 J	1.00E+04	9.90E+03 J	8.30E+03	7.60E+03	1.40E+04 J
Arsenic	4.10E+00	4.10E+00	4.90E+00	3.70E+00	4.20E+00	2.70E+00	4.30E+00
Barium	8.20E+01	8.10E+01	7.40E+01	6.80E+01	6.20E+01	6.40E+01	9.80E+01
Beryllium	1.00E+00 U	1.00E+00 U	1.00E+00 U	1.00E+00 U	1.00E+00 U	1.00E+00 U	2.00E+00 U
Cadmium	2.10E-01 U	2.10E-01 J	2.10E-01 U	2.10E-01 U	2.10E-01 U	3.20E-01 U	2.10E-01 U
Calcium	1.30E+03 J	6.60E+02 J	5.70E+02 J	1.00E+03 J	5.60E+02	5.30E+02	1.50E+03 J
Chromium	2.10E+01 J	2.60E+01 J	2.10E+01	2.20E+01 J	2.90E+01	1.40E+01	2.70E+01 J
Cobalt	2.00E+01 U	1.00E+01 U	2.00E+01 U	1.00E+01 U	8.00E+00 U	7.00E+00 U	2.00E+01 U
Copper	4.00E+01 U	2.00E+01 U	3.00E+01 U	2.00E+01 U	9.00E+00 UJ	6.20E+00	2.00E+01 U
Iron	1.50E+04 J	1.70E+04 J	1.70E+04	1.30E+04 J	1.40E+04	1.40E+04	1.70E+04 J
Lead	2.00E+01	1.70E+01	1.50E+01	1.90E+01	1.60E+01	1.10E+01 J	1.70E+01
Magnesium	7.90E+02	7.50E+02	6.00E+02	6.90E+02	5.00E+02	4.50E+02	1.00E+03
Manganese	8.50E+02 J	6.60E+02 J	8.70E+02	6.50E+02 J	5.70E+02	5.00E+02	7.90E+02 J
Mercury	8.00E-02 UJ	1.50E-01 J	5.00E-02 U	9.00E-02 UJ	9.00E-02 U	7.00E-02 U	1.00E-01 UJ
Nickel	1.50E+01	1.30E+01	1.00E+01	1.30E+01	9.00E+00 U	8.00E+00 U	1.40E+01
Potassium	6.30E+02 U	5.40E+02 U	4.20E+02	6.40E+02 U	4.20E+02 U	3.10E+02 U	6.60E+02 U
Selenium	1.00E+00 U	1.20E+00 J	1.00E+00 U	6.90E-01 U	7.00E-01 U	6.80E-01 U	1.00E+00 U
Silver	8.30E-01 U	8.10E-01 U	2.00E+00 U	8.10E-01 U	1.00E+00 U	2.00E+00 U	1.00E+00 U
Vanadium	1.80E+01	2.10E+01	2.00E+01	1.70E+01	1.60E+01	1.50E+01	2.20E+01
Zinc	5.90E+01 J	5.10E+01 J	5.00E+01 U	5.80E+01 J	4.00E+01 U	3.00E+01 U	5.90E+01 J
Cyanide	6.10E-01 U	5.40E-01 U	5.80E-01 U	5.70E-01 U	5.50E-01 U	5.60E-01 U	5.70E-01 U

J = Chemical was identified but below the sample quantitation limit (SQL). Value presented was estimated.

U = Chemical was analyzed for, but not detected. Value represents the SQL.

UJ = Chemical was analyzed for, but not detected. The quantitation limit may be inaccurate or imprecise.

UR = Chemical was analyzed for, but not detected. Quality control indicated that the data are unusable.

Table A-1 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Tar Dump
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	SC-9M TP9-H002 7-12"	SC-9L TP9-H003 13-24"	SC-10U TP10-H001 0-6"	SC-10M TP10-H002 7-12"	SC-10L TP10-H003 13-24"
<i>Organics</i>					
Acetone	1.20E+01 U	1.20E+01 U	1.30E+01 U	1.30E+01 U	2.20E+01 U
Aldrin	9.90E+00 U	1.00E+01 U	4.30E+00 U	4.00E+01 U	3.00E+00 U
alpha - BHC	6.60E+01 UR	1.10E+02	2.20E+02 U	6.10E+00 U	2.10E+01
beta-BHC	2.60E+01 UR	2.70E+01	1.00E+02 UR	5.50E+02	3.30E+01
delta-BHC	1.20E+01 UR	1.70E+01 UR	5.50E+01	2.10E+02	7.00E+00 U
gamma-BHC	1.60E+01	2.80E+01	6.40E+01	1.80E+02	7.10E+00
Carbazole	3.80E+02 U	8.00E+02 U	4.20E+02 U	1.70E+03 U	9.90E+01 J
alpha-Chlordane	9.90E+00 U	1.00E+01 U	3.00E+01 U	7.10E+01 UR	2.30E+01 UR
gamma-Chlordane	9.90E+00 U	1.00E+01 U	4.30E+00 U	2.10E+01 UR	2.00E+00 U
DDD	1.90E+01 U	2.00E+01 U	1.00E+01 U	5.00E+01 U	2.70E+00 J
DDT	1.90E+01 U	2.00E+01 U	7.00E+00 U	5.00E+01 U	3.80E+00 U
Dibenzofuran	3.80E+02 U	8.00E+02 U	4.20E+02 U	1.70E+03 U	7.60E+02 U
Dieldrin	1.90E+01 U	2.00E+01 U	5.70E+01	2.30E+02	1.20E+01
Endosulfan I	9.90E+00 U	1.00E+01 U	1.60E+01	4.10E+01 UR	2.30E+01 UR
Endosulfan II	1.90E+01 U	2.00E+01 U	8.40E+00 U	4.70E+01	3.40E+00 J
Endrin	1.90E+01 U	2.00E+01 U	8.40E+00 U	7.00E+01	3.80E+00 U
Endrin aldehyde	1.90E+01 U	2.00E+01 U	8.40E+00 U	3.90E+01	5.00E+00 U
Heptachlor	9.90E+00 U	1.00E+01 U	5.00E+00 U	6.10E+00 U	2.00E+00 U
Heptachlor epoxide	9.90E+00 U	1.00E+01 U	2.00E+01 U	2.70E+01	2.00E+00 U
Hexachlorobenzene	3.80E+02 U	8.00E+02 U	4.20E+02 U	1.70E+03 U	7.60E+02 U
Methoxychlor	9.90E+01	1.00E+02 U	4.30E+01 U	6.10E+01 U	2.00E+01 U
2-Methylnaphthalene	3.80E+02 U	8.00E+02 U	4.20E+02 U	1.70E+03 U	7.60E+02 U
Naphthalene	3.80E+02 U	8.00E+02 U	4.20E+02 U	1.70E+03 U	1.30E+02 J
PAHs					
Acenaphthylene	9.60E+01 J	1.70E+02 J	1.50E+02 J	1.10E+03 J	3.90E+02 J
Anthracene	1.20E+02 J	3.60E+02 J	2.00E+02 J	8.20E+02 J	5.50E+02 J
Benzo(a)anthracene	1.00E+03	2.40E+03	1.40E+03	5.90E+03	4.00E+03
Benzo(a)pyrene	1.20E+03	2.60E+03	1.80E+03	6.80E+03	3.50E+03
Benzo(b and/or k)fluoranthene	2.60E+03	5.20E+03	3.90E+03	1.40E+04	7.20E+03
Benzo(g,h,i)perylene	6.90E+02	1.30E+03	8.40E+02	4.20E+03	1.80E+03
Chrysene	1.20E+03	2.70E+03	1.70E+03	6.70E+03	4.10E+03
Dibenzo(a,h)anthracene	3.80E+02 J	6.80E+02 J	4.30E+02	2.30E+03	1.10E+03
Fluoranthene	1.20E+03	3.90E+03	1.80E+03	7.80E+03	5.70E+03
Indeno(1,2,3-cd)pyrene	9.90E+02	1.90E+03	1.20E+03	6.20E+03	2.60E+03
Phenanthrene	2.10E+02 J	7.50E+02 J	2.90E+02 J	9.70E+02 J	1.30E+03

Table A-1 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Tar Dump
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	91955 SC-9M TP9-H002 7-12"	91947 SC-9L TP9-H003 13-24"	91952 SC-10U TP10-H001 0-6"	91926 SC-10M TP10-H002 7-12"	91927 SC-10L TP10-H003 13-24"
<i>Organics (continued)</i>					
Pyrene	1.20E+03	3.40E+03	1.50E+03	6.10E+03	4.00E+03
Tetrachloroethene	1.20E+01 U	1.20E+01 U	1.30E+01 U	1.30E+01 U	2.20E+01 U
1,1,1-Trichloroethane	1.20E+01 U	1.20E+01 U	1.30E+01 U	1.30E+01 U	2.20E+01 U
Trichloroethylene	1.20E+01 U	1.20E+01 U	1.30E+01 U	3.00E+00 J	2.20E+01 U
Xylenes (total)	1.20E+01 U	1.00E+00 J	1.30E+01 U	1.30E+01 U	2.20E+01 U
<i>Inorganics</i>					
Aluminum	1.30E+04 J	7.90E+03	1.30E+04 J	8.70E+03	9.40E+03
Arsenic	6.80E+00	3.00E+00	5.60E+00	6.60E+00	6.10E+00
Barium	9.70E+01	7.70E+01	9.70E+01	1.00E+02	1.10E+02
Beryllium	2.00E+00 U	1.00E+00 U	1.00E+00 U	1.00E+00 U	2.00E+00 U
Cadmium	2.10E-01 U	1.00E+00 U	2.20E-01 U	3.40E-01 U	1.00E+00 U
Calcium	1.40E+03 J	9.60E+02	1.50E+03 J	1.70E+03	1.70E+03
Chromium	6.90E+01 J	1.20E+01	4.80E+01 J	9.80E+01	3.90E+01
Cobalt	1.90E+01	6.00E+00 U	2.00E+01 U	2.00E+01 U	1.70E+01
Copper	3.00E+01 U	5.00E+00 UJ	3.00E+01 U	2.00E+01 U	2.00E+01 U
Iron	1.80E+04 J	1.10E+04	1.70E+04 J	1.50E+04	1.70E+04
Lead	3.00E+01	9.10E+00	2.50E+01	3.60E+01 J	2.70E+01 J
Magnesium	8.80E+02	5.60E+02	8.70E+02	5.80E+02	6.60E+02
Manganese	1.10E+03 J	5.70E+02	8.30E+02 J	5.50E+02	1.20E+03
Mercury	6.00E-02 U	9.00E-02 U	1.00E-01 UJ	1.40E-01	3.90E-01
Nickel	1.90E+01	9.00E+00 U	1.60E+01	1.90E+01	2.90E+01
Potassium	7.00E+00	3.80E+02 U	6.40E+02 U	4.40E+02 U	4.90E+02 U
Selenium	1.00E+00 U	7.20E-01 U	7.30E-01 U	1.00E+00 U	7.30E-01 U
Silver	1.00E+00 U	8.40E-01 U	8.60E-01 U	3.00E+00 U	3.00E+00 U
Vanadium	2.10E+01	1.40E+01	2.20E+01	1.90E+01	2.00E+01
Zinc	8.10E+01 J	4.00E+01 U	8.20E+01 J	7.90E+01	8.90E+01
Cyanide	6.00E-01 U	5.90E-01 U	5.90E-01 U	6.00E-01 U	6.20E-01 U

J = Chemical was identified but below the sample quantitation limit (SQL). Value presented was estimated.

U = Chemical was analyzed for, but not detected. Value represents the SQL.

UJ = Chemical was analyzed for, but not detected. The quantitation limit may be inaccurate or imprecise.

UR = Chemical was analyzed for, but not detected. Quality control indicated that the data are unusable.

Table A-2
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Hamill Road Dump #3
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	91930 SC-15U TP1-H001 0-6"	91931 SC-15M TP1-H002 7-12"	91932 SC-15L TP1-H003 13-24"	91929 SC-16U TP2-H001 0-6"	91928 SC-16M TP2-H002 7-12"	91934 SC-16L TP2-H003 13-24"	91939 SC-17U TP3-H001 0-6"
<i>Organics</i>							
Aldrin	4.00E+00 U	2.20E+01 U	1.10E+01 U	1.30E+00 J	2.10E+00 U	2.20E+00 U	1.10E+01 U
beta-BHC	2.70E+02 U	1.10E+02 U	4.00E+01 U	5.00E+00 U	2.10E+00 U	1.40E+00 J	3.80E+02
delta-BHC	8.20E+01	4.00E+01	1.60E+01	3.20E+00	2.10E+00 U	2.20E+00 U	1.10E+01 U
gamma-BHC	8.70E+01 UR	4.60E+01 UR	1.70E+01	4.40E+00	2.10E+00 U	2.20E+00 U	1.10E+02
Carbazole	2.40E+04 U	5.50E+02 J	1.10E+02 J	6.70E+01 J	4.10E+02 U	4.20E+02 U	5.30E+01 J
alpha-Chlordane	3.60E+02 UR	1.50E+02 U	4.00E+01 U	1.00E+01 U	1.90E+00 J	2.20E+00 U	6.00E+01 U
DDD	2.00E+01 U	4.30E+01 U	2.10E+01 U	5.90E+00 UR	4.10E+00 U	4.20E+00 U	9.00E+01 U
DDT	4.40E+01	4.30E+01 U	1.20E+01 J	8.00E+00 U	4.10E+00 U	4.20E+00 U	5.00E+01 U
Dibenzofuran	2.40E+04 U	1.80E+02 J	8.60E+02 U	4.40E+02 U	4.10E+02 U	4.20E+02 U	4.20E+02 U
Dieldrin	1.00E+02	4.40E+01 UR	1.50E+01 J	1.90E+01	4.10E+00 U	4.20E+00 U	2.40E+02
Endosulfan I	2.70E+02 UR	1.20E+02 UR	2.70E+01	8.20E+00	2.10E+00 U	2.20E+00 U	5.00E+01
Endosulfan II	2.00E+01 U	4.30E+01 U	1.10E+01 J	3.70E+00 UR	4.10E+00 U	4.20E+00 U	5.40E+01
Endosulfan sulfate	3.10E+01	4.30E+01 U	2.10E+01 U	4.40E+00 U	4.10E+00 U	4.20E+00 U	2.10E+01 U
Endrin	7.80E+00 U	4.30E+01 U	2.10E+01 U	4.40E+00 U	2.30E+00 J	4.20E+00 U	3.20E+01
Heptachlor	4.00E+00 U	2.20E+01 U	1.10E+01 U	8.50E+00	2.10E+00 U	2.20E+00 U	1.10E+01 U
Hexachlorobenzene	2.40E+04 U	1.20E+03 U	8.60E+02 U	4.40E+02 U	4.10E+02 U	4.20E+02 U	5.40E+01 J
2-Methylnaphthalene	2.40E+04 U	1.20E+03 U	8.60E+02 U	4.40E+02 U	4.10E+02 U	4.20E+02 U	4.20E+02 U
Naphthalene	2.40E+04 U	3.40E+02 J	1.60E+02 J	4.40E+02 U	4.10E+02 U	4.20E+02 U	6.00E+01 J
PAHs							
Acenaphthylene	2.40E+04 U	1.60E+03	4.40E+02 J	9.90E+01 J	4.10E+02 U	4.20E+02 U	1.50E+02 J
Anthracene	2.50E+03 J	9.20E+02 J	4.40E+02 J	1.30E+02 J	4.10E+02 U	4.20E+02 U	2.30E+02 J
Benzo(a)anthracene	2.00E+04 J	5.90E+03	3.30E+03	1.10E+03	2.30E+02 J	4.20E+02 U	1.30E+03
Benzo(a)pyrene	1.90E+04 J	7.40E+03	3.00E+03	9.90E+02	2.10E+02 J	4.20E+02 U	1.30E+03
Benzo(b and/or k)fluoranthene	4.50E+04 J	1.80E+04	6.20E+03	2.10E+03	4.30E+02 J	4.20E+02 U	2.80E+03
Benzo(g,h,i)perylene	2.40E+04 U	4.00E+03	1.60E+03	4.20E+02 J	9.10E+01 J	4.20E+02 U	6.50E+02
Chrysene	2.30E+04 J	7.30E+03	3.50E+03	1.20E+03	2.80E+02 J	4.20E+02 U	1.40E+03
Dibenzo(a,h)anthracene	5.00E+03 J	2.10E+03	8.30E+02 J	2.40E+02 J	5.00E+01 J	4.20E+02 U	3.40E+02 J
Fluoranthene	3.90E+04	9.20E+03	5.60E+03	1.90E+03	3.60E+02 J	4.20E+02 U	1.90E+03
Indeno(1,2,3-cd)pyrene	1.30E+04 J	5.60E+03	2.10E+03	6.00E+02	1.30E+02 J	4.20E+02 U	8.60E+02
Phenanthrene	5.70E+03 J	2.80E+03	6.10E+02 J	5.00E+02	7.20E+01 J	4.20E+02 U	4.00E+02 J
Pyrene	3.70E+04	6.80E+03	4.10E+03	1.40E+03	2.60E+02 J	4.20E+02 U	1.40E+03
Styrene	1.20E+01 UJ	1.40E+01 U	1.30E+01 U	2.00E+00 J	7.00E+00 J	1.30E+01 U	1.30E+01 UJ
1,1,1-Trichloroethane	3.50E+01	7.00E+00 J	6.00E+00 J	9.00E+00 J	2.60E+01	1.70E+01	1.40E+01 J
Xylenes (total)	1.20E+01 UJ	1.40E+01 U	1.30E+01 U	1.30E+01 UJ	1.30E+01 U	1.30E+01 U	1.30E+01 UJ

Table A-2 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Hamill Road Dump #3
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	91930 SC-15U TP1-H001 0-6"	91931 SC-15M TP1-H002 7-12"	91932 SC-15L TP1-H003 13-24"	91929 SC-16U TP2-H001 0-6"	91928 SC-16M TP2-H002 7-12"	91934 SC-16L TP2-H003 13-24"	91939 SC-17U TP3-H001 0-6"
<i>Inorganics</i>							
Aluminum	1.20E+04	1.30E+04	1.20E+04	1.10E+04	9.40E+03	9.40E+03	9.20E+03
Arsenic	1.10E+01	1.20E+01	7.20E+00	1.10E+01	8.80E+00	4.70E+00	7.90E+00
Barium	1.10E+02	9.60E+01	9.40E+01	9.90E+01	8.80E+01	9.60E+01	8.60E+01
Beryllium	1.00E+00 U	1.00E+00 U	1.00E+00 U	1.00E+00 U	1.00E+00 U	1.00E+00 U	1.00E+00 U
Calcium	2.30E+03	1.90E+03	1.70E+03	1.50E+03	7.80E+02	6.70E+02	1.70E+03
Chromium	5.90E+01	7.20E+01	2.40E+01	6.60E+01	2.40E+01	1.30E+01	6.00E+01
Cobalt	1.60E+01	9.00E+00 U	7.00E+00 U	1.80E+01	1.80E+01	2.00E+01 U	1.30E+01
Copper	5.40E+01 J	4.00E+01 UJ	3.00E+01 UJ	5.00E+01 UJ	2.00E+01 U	2.00E+01 UJ	3.00E+01 UJ
Iron	2.00E+04	2.00E+04	1.70E+04	2.00E+04	1.60E+04	1.50E+04	1.60E+04
Lead	7.40E+01	6.50E+01	2.80E+01	6.80E+01	2.40E+01 J	1.40E+01	5.90E+01
Magnesium	9.10E+02	9.10E+02	7.90E+02	8.00E+02	5.80E+02	6.00E+02	7.30E+02
Manganese	8.00E+02	3.40E+02	1.90E+02	1.30E+03	8.00E+02	1.60E+03	7.00E+02
Mercury	2.00E-01 U	4.20E-01	2.00E-01 U	3.20E-01	1.30E-01	6.00E-02 U	2.10E-01
Nickel	2.50E+01	2.10E+01	1.40E+01	2.70E+01	2.10E+01	1.30E+01	1.60E+01
Potassium	7.70E+02 U	8.30E+02 U	6.50E+02 U	6.90E+02 U	4.90E+02 U	4.70E+02 U	5.90E+02 U
Selenium	2.10E+00	2.30E+00	7.60E-01 U	1.00E+00 U	7.40E-01 U	7.60E-01 U	1.00E+00 U
Vanadium	2.50E+01	2.60E+01	2.30E+01	2.30E+01	1.90E+01	1.80E+01	1.90E+01
Zinc	1.30E+02	9.30E+01	5.50E+01	1.30E+02	6.70E+01	3.50E+01	9.50E+01
Cyanide	1.50E+00	6.40E-01 U	6.60E-01	6.90E-01 U	6.00E-01 U	6.10E-01 U	6.00E-01 U

J = Chemical was identified but below the sample quantitation limit (SQL). Value presented was estimated.

U = Chemical was analyzed for, but not detected. Value represents the SQL.

UJ = Chemical was analyzed for, but not detected. The quantitation limit may be inaccurate or imprecise.

UR = Chemical was analyzed for, but not detected. Quality control indicated that the data are unusable.

Table A-2 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Hamill Road Dump #3
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	91938 SC-17M TP3-H002 7-12"	91933 SC-17L TP3-H003 13-24"	91961 SC-18U TP4-H001 0-6"	91959 SC-18M TP4-H002 7-12"	91962 SC-18L TP4-H003 13-24"	91946 SC-19U TP5-H001 0-6"	91945 SC-19M TP5-H002 7-12"
<i>Organics</i>							
Aldrin	2.00E+01 U	2.10E+00 U	2.30E+00 U	2.20E+00 U	2.30E+00 U	2.20E+01 U	2.10E+00 U
beta-BHC	4.70E+01	1.30E+00 UR	2.00E+01 U	2.20E+00 U	2.30E+00 U	1.40E+02 U	2.10E+00 U
delta-BHC	2.00E+01 U	2.10E+00 U	4.40E+00	2.20E+00 U	2.30E+00 U	5.00E+01	2.10E+00 U
gamma-BHC	1.10E+01 J	2.10E+00 U	4.60E+00	2.20E+00 U	2.30E+00 U	6.50E+01 UR	2.10E+00 U
Carbazole	3.90E+02 U	4.00E+02 U	1.10E+03 U	4.20E+02 U	4.50E+02 U	4.30E+02 U	4.10E+02 U
alpha-Chlordane	2.00E+01 U	2.10E+00 U	2.30E+00 U	2.20E+00 U	2.30E+00 U	2.50E+02 U	3.00E+00 U
DDD	3.90E+01 U	4.00E+00 U	4.50E+00 U	4.20E+00 U	4.50E+00 U	4.30E+01 U	4.10E+00 U
DDT	3.90E+01 U	4.00E+00 U	4.50E+00 U	4.20E+00 U	4.50E+00 U	4.30E+01 U	4.10E+00 U
Dibenzofuran	3.90E+02 U	4.00E+02 U	1.10E+03 U	4.20E+02 U	4.50E+02 U	4.30E+02 U	4.10E+02 U
Dieldrin	3.00E+01 J	4.00E+00 U	1.20E+01	4.20E+00 U	4.50E+00 U	7.60E+01	4.10E+00 U
Endosulfan I	2.00E+01 U	2.10E+00 U	1.50E+01	2.20E+00 U	2.30E+00 U	2.00E+02	2.10E+00 U
Endosulfan II	3.90E+01 U	4.00E+00 U	5.00E+00	4.20E+00 U	4.50E+00 U	4.30E+01 U	4.10E+00 U
Endosulfan sulfate	3.90E+01 U	4.00E+00 U	4.50E+00 U	4.20E+00 U	4.50E+00 U	4.30E+01 U	4.10E+00 U
Endrin	3.90E+01 U	4.00E+00 U	4.50E+00 U	4.20E+00 U	4.50E+00 U	4.30E+01 U	4.10E+00 U
Heptachlor	2.00E+01 U	2.10E+00 U	6.00E+00 U	2.20E+00 U	2.30E+00 U	2.20E+01 U	2.10E+00 U
Hexachlorobenzene	3.90E+02 U	4.00E+02 U	1.10E+03 U	4.20E+02 U	4.50E+02 U	4.30E+02 U	4.10E+02 U
2-Methylnaphthalene	3.90E+02 U	4.00E+02 U	1.10E+03 U	4.20E+02 U	4.50E+02 U	4.30E+02 U	4.10E+02 U
Naphthalene	3.90E+02 U	4.00E+02 U	1.70E+02 J	5.20E+01 J	4.50E+02 U	7.50E+01 J	4.10E+02 U
<i>PAHs</i>							
Acenaphthylene	3.90E+02 U	4.00E+02 U	2.50E+02 J	4.20E+02 U	4.50E+02 U	8.00E+01 J	4.10E+02 U
Anthracene	4.90E+01 J	4.00E+02 U	4.20E+02 J	4.60E+01 J	4.50E+02 U	8.90E+01 J	4.10E+02 U
Benzo(a)anthracene	2.40E+02 J	4.00E+02 U	2.70E+03	5.40E+02	5.60E+01 J	6.40E+02	1.70E+02 J
Benzo(a)pyrene	2.80E+02 J	4.00E+02 U	8.10E+02 J	8.80E+01 J	9.60E+01 J	7.50E+02	1.80E+02 J
Benzo(b and/or k)fluoranthene	5.60E+02 J	4.00E+02 U	5.30E+03	1.10E+03	1.80E+02 J	1.80E+03	4.10E+02 J
Benzo(g,h,i)perylene	3.90E+02 U	4.00E+02 U	1.10E+03 U	4.20E+02 U	4.50E+02 U	3.70E+02 J	4.10E+02 U
Chrysene	2.90E+02 J	4.00E+02 U	2.90E+03	5.00E+02	9.40E+01 J	8.00E+02	2.10E+02 J
Dibenzo(a,h)anthracene	6.60E+01 J	4.00E+02 U	5.40E+02 J	1.50E+02 J	4.50E+02 U	2.50E+02 J	4.10E+02 U
Fluoranthene	3.80E+02 J	4.00E+02 U	6.00E+03	6.80E+02	9.70E+01 J	9.20E+02	2.60E+02 J
Indeno(1,2,3-cd)pyrene	1.70E+02 J	4.00E+02 U	7.60E+02 J	1.20E+02 J	8.30E+01 J	6.60E+02	1.50E+02 J
Phenanthrene	9.30E+01 J	4.00E+02 U	7.00E+02 J	1.70E+02 J	4.50E+02 U	2.60E+02 J	6.00E+01 J
Pyrene	2.70E+02 J	4.00E+02 U	2.20E+03	1.60E+02 J	2.10E+02 J	8.60E+02	2.20E+02 J
Styrene	1.20E+01 U	1.20E+01 U	1.40E+01 U	1.30E+01 U	1.40E+01 U	1.30E+01 U	1.20E+01 U
1,1,1-Trichloroethane	8.00E+00 J	1.00E+01 J	1.40E+01 U	1.30E+01 U	1.40E+01 U	1.50E+01	1.50E+01
Xylenes (total)	1.20E+01 U	1.20E+01 U	1.40E+01 U	1.30E+01 U	1.40E+01 U	1.30E+01 U	1.20E+01 U

Table A-2 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from Hamill Road Dump #3
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	91938 SC-17M TP3-H002 7-12"	91933 SC-17L TP3-H003 13-24"	91961 SC-18U TP4-H001 0-6"	91959 SC-18M TP4-H002 7-12"	91962 SC-18L TP4-H003 13-24"	91946 SC-19U TP5-H001 0-6"	91945 SC-19M TP5-H002 7-12"
<i>Inorganics</i>							
Aluminum	4.30E+03	6.90E+03	1.20E+04	1.20E+04	1.60E+04	1.20E+04	1.20E+04
Arsenic	2.20E+00	3.30E+00	1.10E+01	9.00E+00	5.80E+00	8.30E+00	5.70E+00
Barium	4.00E+01	7.30E+01	1.20E+02	1.00E+02	1.30E+02	1.00E+02	1.00E+02
Beryllium	1.00E+00 U	1.00E+00 U	2.00E+00 U	1.00E+00 U	2.00E+00 U	1.00E+00 U	2.00E+00 U
Calcium	4.50E+02	8.60E+02	1.30E+03 J	1.20E+03 J	1.70E+03 J	1.40E+03	1.10E+03
Chromium	9.20E+00	1.10E+01	4.00E+01	2.80E+01	1.70E+01	4.50E+01	1.70E+01
Cobalt	5.00E+00 U	7.00E+00 U	1.50E+01	1.80E+01	1.50E+01	1.40E+01	1.30E+01
Copper	6.00E+00 UJ	9.00E+00 UJ	3.00E+01 U	3.00E+01 U	2.00E+01 U	2.00E+01 UJ	1.00E+01 UJ
Iron	7.80E+03	1.20E+04	2.10E+04	1.90E+04	2.10E+04	1.80E+04	1.70E+04
Lead	1.00E+01	1.00E+01	4.10E+01	2.90E+01	1.70E+01	5.20E+01	1.90E+01
Magnesium	3.00E+02	4.80E+02	7.70E+02	7.60E+02	1.10E+03	8.10E+02	7.10E+02
Manganese	3.50E+02	5.50E+02	8.70E+02	1.50E+03	1.10E+03	1.10E+03	1.40E+03
Mercury	6.00E-02 U	6.00E-02 U	3.10E-01 J	6.00E-02 U	7.00E-02 U	2.00E-01 U	1.00E-01 U
Nickel	5.00E+00 U	9.00E+00 U	1.80E+01	1.60E+01	1.40E+01	1.80E+01	1.30E+01
Potassium	2.40E+02 U	3.30E+02 U	6.00E+02 U	5.70E+02 U	7.90E+02 U	6.40E+02	4.30E+02 U
Selenium	6.40E-01 U	7.30E-01 U	2.00E+00 U	1.60E+00	1.40E+00	2.00E+00 U	1.00E+00 U
Vanadium	9.00E+00 U	1.40E+01	2.40E+01	2.20E+01	2.40E+01	2.20E+01	2.00E+01
Zinc	3.00E+01 U	3.40E+01	7.80E+01	6.30E+01	5.30E+01	1.00E+02	4.40E+01
Cyanide	5.50E-01 U	6.10E-01 U	6.60E-01 U	6.00E-01 U	6.70E-01 U	6.40E-01 U	6.00E-01 U

J = Chemical was identified but below the sample quantitation limit (SQL). Value presented was estimated.

U = Chemical was analyzed for, but not detected. Value represents the SQL.

UJ = Chemical was analyzed for, but not detected. The quantitation limit may be inaccurate or imprecise.

UR = Chemical was analyzed for, but not detected. Quality control indicated that the data are unusable.

Table A-2 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from
Hamill Road Dump #3
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	91944 SC-19L TP5-H003 13-24"	91937 SC-20U TP6-H001 0-6"	91936 SC-20M TP6-H002 7-12"	91935 SC-20L TP6-H003 13-24"
<i>Organics</i>				
Aldrin	2.20E+00 U	1.10E+01 U	4.20E+00 U	2.10E+00 U
beta-BHC	2.20E+00 U	1.60E+02 U	9.00E+00 U	2.10E+00 U
delta-BHC	2.20E+00 U	9.30E+01	4.20E+00 U	2.10E+00 U
gamma-BHC	2.20E+00 U	4.00E+01 U	4.20E+00 U	2.10E+00 U
Carbazole	4.20E+02 U	1.30E+02 J	4.10E+02 U	4.10E+02 U
alpha-Chlordane	2.20E+00 U	5.00E+01 U	4.20E+00 U	2.10E+00 U
DDD	4.20E+00 U	2.20E+01 U	8.20E+00 U	4.10E+00 U
DDT	4.20E+00 U	3.00E+01 U	8.20E+00 U	4.10E+00 U
Dibenzofuran	4.20E+02 U	5.60E+01 J	4.10E+02 U	4.10E+02 U
Dieldrin	4.20E+00 U	3.40E+02	2.10E+01	4.10E+00 U
Endosulfan I	2.20E+00 U	3.80E+01	4.20E+00 U	2.10E+00 U
Endosulfan II	4.20E+00 U	4.50E+01	8.20E+00 U	4.10E+00 U
Endosulfan sulfate	4.20E+00 U	2.20E+01 U	8.20E+00 U	4.10E+00 U
Endrin	4.20E+00 U	2.20E+01 U	8.20E+00 U	4.10E+00 U
Heptachlor	2.20E+00 U	9.20E+01	7.00E+00 UR	2.10E+00 U
Hexachlorobenzene	4.20E+02 U	3.00E+02 J	4.10E+02 U	4.10E+02 U
2-Methylnaphthalene	4.20E+02 U	8.20E+01 J	4.10E+02 U	4.10E+02 U
Naphthalene	4.20E+02 U	1.80E+02 J	4.10E+02 U	4.10E+02 U
PAHs				
Acenaphthylene	4.20E+02 U	3.40E+02 J	4.10E+02 U	4.10E+02 U
Anthracene	4.20E+02 U	4.90E+02 J	4.10E+02 U	4.10E+02 U
Benzo(a)anthracene	4.20E+02 U	1.80E+03	1.20E+02 J	4.10E+02 U
Benzo(a)pyrene	4.20E+02 U	2.00E+03	1.40E+02 J	4.10E+02 U
Benzo(b and/or k)fluoranthene	4.20E+02 U	4.20E+03	3.00E+02 J	4.10E+02 U
Benzo(g,h,i)perylene	4.20E+02 U	1.10E+03	6.40E+01 J	4.10E+02 U
Chrysene	4.20E+02 U	2.10E+03	1.60E+02 J	4.10E+02 U
Dibenzo(a,h)anthracene	4.20E+02 U	5.80E+02	4.10E+02 U	4.10E+02 U
Fluoranthene	4.20E+02 U	2.80E+03	1.90E+02 J	4.10E+02 U
Indeno(1,2,3-cd)pyrene	4.20E+02 U	1.50E+03	8.50E+01 J	4.10E+02 U
Phenanthrene	4.20E+02 U	8.20E+02	4.60E+01 J	4.10E+02 U
Pyrene	4.20E+02 U	2.20E+03	1.40E+02 J	4.10E+02 U
Styrene	1.30E+01 U	1.40E+01 UJ	1.30E+01 U	1.20E+01 U
1,1,1-Trichloroethane	7.00E+00 J	1.20E+01 J	5.00E+00 J	4.00E+00 J
Xylenes (total)	2.00E+00 J	1.40E+01 UJ	1.30E+01 U	3.00E+00 J

Table A-2 (continued)
Summary of Chemicals Detected in Subsurface Soils (0 to 2 feet deep) Collected from
Hamill Road Dump #3
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	91944 SC-19L TP5-H003 13-24"	91937 SC-20U TP6-H001 0-6"	91936 SC-20M TP6-H002 7-12"	91935 SC-20L TP6-H003 13-24"
<i>Inorganics</i>				
Aluminum	1.30E+04	1.30E+04	1.40E+04	1.40E+04
Arsenic	5.00E+00	9.60E+00	5.30E+00	4.40E+00
Barium	1.30E+02	1.30E+02	1.00E+02	1.20E+02
Beryllium	1.50E+00	2.00E+00 U	1.00E+00 U	2.00E+00 U
Calcium	9.50E+02	1.80E+03	1.20E+03	1.30E+03
Chromium	1.20E+01	8.60E+01	2.20E+01	2.10E+01
Cobalt	1.50E+01	1.60E+01	2.00E+01 U	2.00E+01 U
Copper	9.00E+00 UJ	3.00E+01 UJ	2.00E+01 UJ	1.00E+01 UJ
Iron	1.90E+04	2.10E+04	1.80E+04	1.90E+04
Lead	1.90E+01	6.50E+01	1.90E+01	1.90E+01
Magnesium	6.50E+02	9.00E+02	8.50E+02	8.10E+02
Manganese	2.00E+03	1.30E+03	1.00E+03	1.50E+03
Mercury	8.00E-02 U	3.30E-01	9.00E-02 U	8.00E-02 U
Nickel	1.10E+01	2.00E+01	1.30E+01	1.20E+01
Potassium	3.80E+02 U	7.30E+02 U	5.00E+02 U	4.30E+02 U
Selenium	7.10E-01 U	7.90E-01 U	6.90E-01 U	7.50E-01 U
Vanadium	2.10E+01	2.50E+01	2.30E+01	2.40E+01
Zinc	4.00E+01 U	1.40E+02	6.20E+01	5.30E+01
Cyanide	6.00E-01 U	6.50E-01 U	6.00E-01 U	6.10E-01 U

J = Chemical was identified but below the sample quantitation limit (SQL). Value presented was estimated.

U = Chemical was analyzed for, but not detected. Value represents the SQL.

UJ = Chemical was analyzed for, but not detected. The quantitation limit may be inaccurate or imprecise.

UR = Chemical was analyzed for, but not detected. Quality control indicated that the data are unusable.

Table A-3
Summary of Chemicals Detected in Surface Water Collected from Chattanooga Creek
Units: Organics (µg/L), Inorganics (mg/L)
Tennessee Products Site, Chattanooga, TN

Chemical	WC-2 T1-D001	WC-3 T2-D001	WC-4 T3-D001	WC-5 T4-D001	WC-6 T5-D001	WC-7 T6-D001	WC-9 T7-D001	WC-8 (Background)
<i>Organics</i>								
Bis(2-ethylhexyl)phthalate	1.00E+01 U	1.00E+01 U	1.00E+01 U	1.30E+01	1.00E+01 U	1.00E+01 U	1.00E+01 U	1.00E+01 U
<i>Inorganics</i>								
Aluminum	4.90E-01	3.30E-01	3.20E-01	2.10E-01	1.80E-01	1.70E-01	1.90E-01	1.60E-01
Barium	4.20E-02	2.60E-02	2.60E-02	2.50E-02	2.40E-02	2.50E-02	2.50E-02	2.50E-02
Calcium	3.50E+01	2.20E+01	2.30E+01	2.30E+01	2.30E+01	2.40E+01	2.50E+01	2.10E+01
Copper	4.10E-03	2.00E-03 U	2.00E-03 U	2.00E-03 U	2.00E-03 U	2.00E-03 U	2.00E-03 U	2.00E-03 U
Iron	1.60E+00	4.30E-01	4.40E-01	3.40E-01	3.20E-01	3.10E-01	3.40E-01	2.90E-01
Magnesium	3.10E+00	3.90E+00	4.00E+00	4.00E+00	4.00E+00	4.00E+00	4.20E+00	4.00E-03
Manganese	4.50E-01	7.20E-02	7.40E-02	7.10E-02	7.10E-02	7.10E-02	7.30E-02	7.00E-02
Potassium	8.00E-01 U	6.60E-01	6.80E-01	6.70E-01	7.40E-01	5.20E-01	7.50E-01	5.40E-01
Sodium	6.80E+00	2.70E+00	2.70E+00	2.70E+00	2.70E+00	2.80E+00	2.90E+00	2.40E+00
Strontium	8.60E-02	7.70E-02	7.80E-02	7.80E-02	7.80E-02	8.10E-02	8.20E-02	7.60E-02
Titanium	9.90E-03	4.10E-03	3.50E-03	2.50E-03	2.20E-03	2.00E-03	2.00E-03 U	2.00E-03 U
Zinc	1.80E-02	4.10E-03	3.20E-03	2.60E-03	2.50E-03	3.00E-03	2.30E-03	2.60E-03

U = Chemical was analyzed for, but not detected. Value represents the sample quantitation limit (SQL).

Table A-4
Summary of Chemicals Detected in Sediment Collected from Chattanooga Creek
Units: Organics (µg/kg), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	DC-1 TP1-H001	DC-2 TP2-H001	DC-3U TP3-H001	DC-4U TP4-H001	DC-5U TP5-H001	DC-6U TP6-H001	DC-7U TP7-H001	DC-9U TP8-H001	DC-8U (Background)
<i>Organics</i>									
Acetone	1.30E+01 U	5.20E+02 U	1.90E+03 U	6.30E+02 U	1.40E+05 U	1.80E+03 J	1.60E+03 J	9.90E+02 U	6.30E+02 U
alpha - BHC	5.50E+02	8.00E+01 U	1.00E+02 U	9.20E+02	4.30E+03	1.90E+03	1.50E+02	2.80E+02	4.70E+01 U
beta-BHC	1.70E+02	3.80E+01	1.00E+02 U	9.70E+02	6.10E+02 J	NR	1.30E+02	1.30E+02 J	4.70E+01 U
delta-BHC	9.00E+01	1.70E+01	1.00E+02 U	2.00E+02 J	4.00E+03 U	1.40E+02 J	2.50E+02 U	2.00E+02 U	4.70E+01 U
gamma-BHC	1.30E+02	2.00E+01	1.00E+02 U	8.40E+02 U	2.20E+03 U	7.20E+02	1.00E+02 U	7.80E+01 J	4.70E+01 U
Carbazole	5.80E+01 J	9.00E+02 U	1.10E+04 U	8.40E+03 U	2.10E+05	7.00E+02 J	2.00E+03 J	4.80E+03 U	6.60E+03 U
Chlorobenzene	1.30E+01 U	1.30E+01 U	1.90E+02 U	6.30E+01 U	3.30E+03 J	5.50E+01 U	1.80E+02 U	4.90E+01 U	6.30E+01 U
o-Chlorotoluene	NR	NR	1.90E+02 U	6.30E+01 U	1.00E+04 J	5.50E+01 U	1.80E+02 U	4.90E+01 U	6.30E+01 U
p-Chlorotoluene	NR	NR	1.90E+02 U	6.30E+01 U	5.10E+03 J	5.50E+01 U	1.80E+02 U	4.90E+01 U	6.30E+01 U
Dibenzofuran	4.30E+02 U	9.00E+02 U	1.10E+04 U	8.60E+02 J	2.80E+05	1.50E+03 J	2.20E+03 J	4.80E+03 U	6.60E+03 U
1,2-Dichlorobenzene	NR	NR	1.90E+02 U	6.30E+01 U	1.70E+03 J	5.50E+01 U	1.80E+02 U	4.90E+01 U	6.30E+01 U
1,4-Dichlorobenzene	NR	NR	1.90E+02 U	6.30E+01 U	2.50E+03 J	5.50E+01 U	1.80E+02 U	4.90E+01 U	6.30E+01 U
Dieldrin	7.60E+01	NR	1.00E+02 U	8.40E+02 U	4.00E+03 U	3.80E+02 U	2.50E+02 U	2.00E+02 U	4.70E+01 U
Endosulfan I	3.90E+01	1.20E+01 U	1.00E+02 U	8.40E+02 U	4.00E+03 U	3.80E+02 U	2.50E+02 U	2.00E+02 U	4.70E+01 U
Endosulfan II	3.00E+01	2.30E+01 U	1.00E+02 U	8.40E+02 U	4.00E+03 U	3.80E+02 U	2.50E+02 U	5.50E+02 U	4.70E+01 U
Ethylbenzene	1.30E+01 U	1.30E+01 U	1.90E+02 U	6.30E+01 U	2.10E+03 J	5.50E+01 U	1.80E+02 U	4.90E+01 U	6.30E+01 U
Heptachlor epoxide	2.20E+01	1.20E+01 U	1.00E+02 U	8.40E+02 U	2.20E+03 U	3.80E+02 U	1.00E+02 U	2.00E+02 U	4.70E+01 U
Hexachlorobenzene	4.60E+01 J	9.00E+02 U	1.10E+04 U	8.40E+03 U	1.30E+05 U	5.90E+03 U	9.10E+03 U	4.80E+03 U	6.60E+03 U
Methoxychlor	5.50E+01	1.20E+02 U	2.50E+02 U	1.70E+03 U	8.70E+03 U	9.20E+02 U	5.10E+02 U	1.40E+03 U	7.40E+01 U
2-Methylnaphthalene	4.30E+02 U	9.00E+02 U	1.10E+04 U	1.50E+03 J	4.80E+05	6.70E+02 J	1.50E+03 J	4.80E+03 U	6.60E+03 U
(3- and/or 4-)Methylphenol	1.70E+02 J	9.00E+02 U	1.10E+04 U	8.40E+03 U	1.30E+05 U	5.90E+03 U	9.10E+03 U	4.80E+03 U	6.60E+03 U
Naphthalene	9.50E+01 J	9.00E+02 U	1.10E+04 U	1.00E+04	1.40E+06	2.50E+03 J	4.60E+03 J	2.30E+03 J	6.60E+03 U
<i>PAHs</i>									
Acenaphthene	4.30E+02 U	9.00E+02 U	1.10E+04 U	8.40E+03 U	3.20E+05	2.00E+03 J	2.60E+03 J	4.80E+03 U	6.60E+03 U
Acenaphthylene	4.60E+02	1.20E+02 J	1.10E+04 U	8.40E+03 U	5.10E+04 J	1.50E+03 J	2.60E+03 J	5.80E+02 J	6.60E+03 U
Anthracene	3.50E+02 J	9.00E+02 U	1.10E+04 U	2.70E+03 J	1.80E+05	5.30E+03 J	8.60E+03 J	1.10E+03 J	7.70E+02 J
Benzo(a)anthracene	3.30E+03	8.90E+02 J	1.10E+04 U	7.90E+03 J	1.30E+05 U	5.90E+03 U	9.10E+03 U	4.80E+03 U	4.10E+03 J
Benzo(b and/or k) fluoranthene	9.00E+03	2.30E+03	1.20E+03 J	1.00E+04	3.80E+05	1.60E+04	2.40E+04	6.70E+03 J	5.60E+03 J
Benzo(g,h,i)perylene	2.20E+03	7.20E+02 J	1.40E+03 J	6.70E+03 J	2.30E+05	1.10E+04	1.60E+04	4.40E+03 J	3.50E+03 J
Benzo(a)pyrene	4.20E+03	1.20E+03	1.10E+04 U	6.30E+03 J	2.50E+05	1.10E+04	1.60E+04	3.90E+03 J	3.50E+03 J
Chrysene	3.80E+03	1.00E+03	1.10E+03 J	6.30E+03 J	1.30E+05 U	5.90E+03 U	9.10E+03 U	4.80E+03 U	4.30E+03 J
Dibenzo(a,h)anthracene	8.20E+02	3.10E+02 J	1.10E+04 U	1.70E+03 J	6.30E+04 J	2.90E+03 J	4.40E+03 J	1.20E+03 J	8.80E+02 J
Fluoranthene	3.00E+03	1.00E+03	1.90E+03 J	1.50E+04	6.70E+05	1.70E+04	2.20E+04	5.10E+03	9.80E+03
Fluorene	4.30E+02 U	9.00E+02 U	1.10E+04 U	1.20E+03 J	4.10E+05	3.30E+03 J	3.80E+03 J	4.80E+03 U	6.60E+03 U
Indeno(1,2,3-cd)pyrene	2.90E+03	8.40E+02 J	1.30E+03 J	6.80E+03 J	2.50E+05	1.10E+04	1.80E+04	4.70E+03 J	3.60E+03 J
Phenanthrene	5.60E+02	1.90E+02 J	1.10E+04 U	5.50E+03 J	1.50E+06	1.50E+04	1.70E+04	2.30E+03 J	4.50E+03 J
Pyrene	3.40E+03	9.20E+02	1.70E+03 J	1.20E+04	5.10E+05	1.40E+04	1.80E+04	4.10E+03 J	7.50E+03
Toluene	1.30E+01 U	1.30E+01 U	1.90E+02 U	6.30E+01 U	7.10E+03 J	5.50E+01 U	1.80E+02 U	4.90E+01 U	6.30E+01 U
o-Xylene	1.30E+01 U	1.30E+01 U	1.90E+02 U	6.30E+01 U	3.40E+03 J	5.50E+01 U	1.80E+02 U	4.90E+01 U	6.30E+01 U

Table A-4 (continued)
Summary of Chemicals Detected in Sediment Collected from Chattanooga Creek
Units: Organics ($\mu\text{g/kg}$), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	DC-1 TP1-H001	DC-2 TP2-H001	DC-3U TP3-H001	DC-4U TP4-H001	DC-5U TP5-H001	DC-6U TP6-H001	DC-7U TP7-H001	DC-9U TP8-H001	DC-8U (Background)
<i>Organics (continued)</i>									
(m- and/or p-) Xylenes	1.30E+01 U	1.30E+01 U	1.90E+02 U	6.30E+01 U	1.10E+04 J	5.50E+01 U	1.80E+02 U	4.90E+01 U	6.30E+01 U
<i>Inorganics</i>									
Aluminum	8.80E+03	1.10E+04	1.10E+04	4.80E+03	3.60E+03	3.40E+03	7.30E+03	2.90E+03	3.60E+03
Arsenic	5.00E+00	5.70E+00	5.80E+00	3.20E+00	4.70E+00	2.30E+00	5.00E+00 U	2.50E+00	2.90E+00
Barium	8.00E+01	9.90E+01	9.70E+01	4.20E+01	3.40E+01	3.10E+01	6.80E+01	3.40E+01	2.50E+01
Beryllium	1.00E+00 U	1.00E+00 U	1.00E+00 U	5.80E-01	5.00E-01 U	5.00E-01 U	7.20E-01	5.00E-01 U	5.00E-01 U
Cadmium	2.30E-01 U	1.00E+00 U	1.00E+00 U	5.00E-01 U	5.00E-01 U	5.00E-01 U	4.80E-01	5.00E-01 U	5.00E-01 U
Calcium	1.40E+03	2.10E+03	7.20E+03	1.40E+03	5.20E+03	1.10E+03	3.50E+03	1.20E+03	9.80E+02
Chromium (total)	3.60E+01	2.70E+01	4.80E+01	3.60E+01	4.60E+01	2.30E+01	3.50E+01	2.60E+01	6.70E+00
Cobalt	2.00E+01 U	1.50E+01	1.40E+01	1.10E+01	6.70E+00	4.90E+00	1.00E+01	6.20E+00	4.70E+00
Copper	2.00E+01 UJ	2.00E+01 UJ	2.70E+01	1.20E+01	6.20E+01	3.20E+01	8.00E+01	1.90E+01	7.60E+00
Iron	1.60E+04	1.80E+04	2.00E+04	8.90E+03	1.00E+04	7.50E+03	1.20E+04	8.10E+03	6.40E+03
Lead	2.40E+01	2.70E+01	5.90E+01	2.70E+01	3.80E+01	1.90E+01	5.20E+01	2.80E+01	2.70E+01
Magnesium	5.50E+02	7.60E+02	1.90E+03	4.80E+02	6.60E+02	3.80E+02	1.20E+03	5.50E+02	4.40E+02
Manganese	5.10E+02	1.30E+03	9.20E+02	4.50E+02	2.70E+02	2.30E+02	3.20E+02	1.80E+02	1.90E+02
Mercury	1.30E-01	2.00E-01 U	1.20E-01	2.50E-01 U	3.50E-01	2.50E-01 U	2.50E-01 U	2.60E-01 U	2.50E-01 U
Molybdenum	NR	NR	1.00E+00 U	1.00E+00 U	1.80E+00	1.00E+00 U	1.50E+00 U	1.00E+00 U	1.00E+00 U
Nickel	1.60E+01	1.50E+01	3.40E+01	1.50E+01	1.10E+01	8.10E+00	2.20E+01	1.20E+01	8.80E+00
Potassium	4.40E+02 U	5.50E+02 U	7.60E+02	4.50E+02	2.60E+02	3.20E+02	4.50E+02	2.50E+02	3.60E+02
Strontium	NR	NR	1.90E+01	1.20E+01	1.20E+01	8.30E+00	1.40E+01	6.20E+00	4.40E+00
Titanium	NR	NR	4.80E+01	6.80E+01	6.00E+01	4.70E+01	5.30E+01	4.70E+01	2.70E+01
Vanadium	1.70E+01	2.00E+01	2.30E+01	1.10E+01	1.10E+01	7.50E+00	1.40E+01	7.70E+00	6.60E+00
Yttrium	NR	NR	1.10E+01	5.30E+00	4.00E+00	3.40E+00	7.90E+00	3.60E+00	2.40E+00
Zinc	6.20E+01	6.30E+01	1.90E+02	6.60E+01	7.50E+01	4.30E+01	1.50E+02	5.00E+01	4.60E+01

J = Chemical was identified but below the sample quantitation limit (SQL). Value presented was estimated.

NR = No value reported. Chemical was not analyzed.

U = Chemical was analyzed for, but not detected. Value represents the SQL.

UJ = Chemical was analyzed for, but not detected. The quantitation limit may be inaccurate or imprecise.

Table A-5
Summary of Chemicals Detected in Clam Tissue
Collected from Chattanooga Creek
Units: Organics ($\mu\text{g/kg}$), Inorganics (mg/kg)
Tennessee Products Site, Chattanooga, TN

Chemical	CC-03 T1-C001	CC-06 T2-C001	CC-07 T3-C001	CC-08 T4-C001 (Background)
<i>Organics</i>				
<i>PAHs</i>				
Benzo(a)anthracene	1.70E+00 U	1.70E+00 U	1.80E-01 J	1.70E+00 U
Chrysene	1.70E+00 U	1.70E+00 U	1.80E-01 J	1.70E+00 U
Fluoranthene	1.70E+00 U	2.40E-01 J	3.00E-01 J	1.70E+00 U
<i>Inorganics</i>				
Aluminum	1.80E+02	1.70E+02	1.80E+02	2.10E+02
Arsenic	1.00E+00 U	2.00E+00 U	1.50E+00	1.00E+00 U
Barium	2.40E+00	2.30E+00	2.20E+00	3.00E+00
Cadmium	1.00E-01 U	1.50E-01 U	1.10E-01	1.10E-01
Calcium	5.60E+02	4.60E+02	4.80E+02	4.40E+02
Chromium (total)	8.00E-01	6.70E-01	7.80E-01	8.70E-01
Cobalt	2.60E-01	3.10E-01	3.50E-01	3.40E-01
Copper	9.40E+00	1.40E+01	1.10E+01	6.90E+00
Iron	3.00E+02	2.60E+02	2.80E+02	3.60E+02
Magnesium	1.20E+02	1.20E+02	1.10E+02	1.10E+02
Manganese	2.20E+01	2.50E+01	2.30E+01	2.90E+01
Mercury	2.30E-02	2.40E-02	2.00E-02	2.00E-02
Nickel	7.60E-01	7.10E-01	7.40E-01	9.90E-01
Potassium	2.70E+02	2.70E+02	2.50E+02	2.10E+02
Selenium	1.00E+00	7.40E-01	1.30E+00	1.10E+00
Sodium	3.80E+02	4.00E+02	4.10E+02	3.50E+02
Strontium	1.20E+00	9.20E-01	9.80E-01	9.30E-01
Titanium	1.20E+00	1.00E+00	1.10E+00	1.50E+00
Vanadium	2.10E-01	1.80E-01	2.50E-01	2.40E-01
Zinc	2.60E+01	3.50E+01	3.30E+01	2.40E+01

J = Chemical was identified but below the sample quantitation limit (SQL).

Value presented was estimated.

U = Chemical was analyzed for, but not detected. Value represents the SQL.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Appendix B
Revision: 0
Date: April 1996

APPENDIX B

FLORA AND FAUNA AT THE TENNESSEE PRODUCTS SITE

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table B-1

**Floristic Occurrence Summary
Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995**

Parameter	Total	Percentage of Site-Wide Occurrence	Percentage of Community Occurrence
Cumulative Site-Wide Occurrence			
Species	255	100.0	NA
Genera	178	100.0	NA
Woody	85	33.3	NA
Herbs ¹	170	66.7	NA
Grasses	20	7.8	NA
Exotics	68	26.7	NA
Early Successional/Ruderal Community			
Species	137	53.7	100.0
Genera	106	59.6	100.0
Woody	40	15.7	29.2
Herbs ¹	97	38.0	70.8
Grasses	17	6.7	12.4
Exotics	58	22.7	42.3
Clearcut Wetland Community			
Species	105	41.2	100.0
Genera	82	46.1	100.0
Woody	30	11.8	28.6
Herbs ¹	75	29.4	71.4
Grasses	2	0.8	1.9
Exotics	14	5.5	13.3

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table B-1

**Floristic Occurrence Summary
Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Parameter	Total	Percentage of Site-Wide Occurrence	Percentage of Community Occurrence
Riparian Forest Community			
Species	111	43.5	100.0
Genera	82	46.1	100.0
Woody	68	26.7	61.3
Herbs ¹	43	16.9	38.7
Grasses	3	1.2	2.7
Exotics	17	6.7	15.3

¹Herb category includes all forbs, grasses, sedges and rushes. Ferns and fern allies, also typically considered herbs, were not present at the study site.

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Acalypha rhomboidea</i>	Three-seed mercury	Herb	N	I	I	
<i>Acer negundo</i>	Boxelder	Tree	N	I		F
<i>Acer rubrum</i>	Red maple	Tree	N	S	O	C
<i>Acer saccharinum</i>	Silver maple	Tree	N			O
<i>Acer saccharum</i>	Sugar maple	Tree	N			I
<i>Agrostis hyemalis</i>	Winter bentgrass	Grass	N	R		
<i>Ailanthus altissima</i>	Tree-of-heaven	Tree	E-Asia	I		R
<i>Albizia julibrissin</i>	Mimosa	Tree	E-Asia	R	R	R
<i>Allium canadense</i>	Wild garlic	Herb	N	R	R	
<i>Allium vineale</i>	Field garlic	Herb	E-Europe	S		
<i>Ambrosia artemisiifolia</i>	Common ragweed	Herb	N	F	R	R
<i>Ambrosia trifida</i>	Giant ragweed	Herb	N	I		S

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Ampelopsis cordata</i>	Heartleaf pepper-vine	Vine	N	I	S	S
<i>Andropogon virginicus</i>	Broomsedge	Grass	N	O	I	
<i>Arctium minus</i>	Burdock	Herb	E-Europe			R
<i>Arisaema dracontium</i>	Green dragon	Herb	N			S
<i>Arundinaria gigantea</i>	River cane	Grass	N			R
<i>Asarum canadense</i>	Wild ginger	Herb	N			VR
<i>Asparagus officinalis</i>	Asparagus	Herb	E-Eurasia	R		
<i>Aster pilosus</i>	Downy aster	Herb	N	O		
<i>Betula nigra</i>	River birch	Tree	N		S	I
<i>Bidens frondosa</i>	Beggar's-ticks	Herb	N	VR		
<i>Bidens</i> sp. ³	Marsh marigold	Herb	N		I	

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Bignonia capreolata</i>	Cross vine	Vine	N			I
<i>Boehmeria cylindrica</i>	False-nettle	Herb	N		I	
<i>Bromus japonicus</i>	Japanese brome	Grass	E-Asia	I		
<i>Broussonetia papyrifera</i>	Paper-mulberry	Tree	E-Asia			R
<i>Campsis radicans</i>	Trumpet creeper	Vine	N	I	S	I
<i>Carex amphibola</i>	Ambiguous sedge	Herb	N			S
<i>Carex annectens</i>	Yellow-fruit sedge	Herb	N		I	
<i>Carex caroliniana</i>	Hirsute sedge	Herb	N			R
<i>Carex cephalophora</i>	Head-bearing sedge	Herb	N			R
<i>Carex cherokeensis</i>	Cherokee sedge	Herb	N	VR		
<i>Carex digitalis</i>	Slender wood sedge	Herb	N	R		

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Carex festucacea</i>	Fescue sedge	Herb	N	S	I	R
<i>Carex frankii</i>	Frank's sedge	Herb	N	VR	F	
<i>Carex leavenworthii</i>	Leavenworth's sedge	Herb	N			VR
<i>Carex lupulina</i>	Hop sedge	Herb	N		O	
<i>Carex lurida</i>	Shallow sedge	Herb	N		I	
<i>Carex retroflexa</i>	Sedge	Herb	N	R		I
<i>Carex socialis</i>	Social sedge	Herb	N			R
<i>Carex tribuloides</i>	Blunt broom sedge	Herb	N		O	
<i>Carex vulpinoidea</i>	Fox sedge	Herb	N	S	F	
<i>Carpinus caroliniana</i>	American hornbeam	Tree	N			S
<i>Carya cordiformis</i>	Bitternut hickory	Tree	N		S	I

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Carya glabra</i>	Pignut hickory	Tree	N			VR
<i>Carya laciniata</i>	Shellbark hickory	Tree	N			VR
<i>Celtis occidentalis</i>	Hackberry	Tree	N	O	S	F
<i>Cephalanthus occidentalis</i>	Buttonbush	Shrub	N		S	S
<i>Cerastium brachypetalum</i>	Short-petalled chickweed	Herb	E-Europe	R		
<i>Cerastium glomeratum</i>	Mouse-ear chickweed	Herb	E-Europe	S		
<i>Cercis canadensis</i>	Eastern redbud	Tree	N	R		R
<i>Chamaesyce maculata</i>	Wartweed	Herb	N	R		
<i>Chenopodium album</i>	Lamb's quarters	Herb	E-Europe	VR		
<i>Cichorium intybus</i>	Chickory	Herb	E-Europe	S		
<i>Cirsium vulgare</i>	Bull thistle	Herb	E-Europe	R		

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Clematis virginiana</i>	Virgin's bower	Vine	N	VR	I	
<i>Cocculus carolinus</i>	Carolina coral-beads	Vine	N			VR
<i>Conyza canadensis</i>	Horseweed	Herb	N		R	
<i>Coreopsis tinctoria</i>	Golden tickseed	Herb	E-Central & Western U.S.	I		
<i>Cornus amomum</i>	Silky dogwood	Shrub	N		S	
<i>Cornus florida</i>	Flowering dogwood	Tree	N			VR
<i>Cornus foemina</i>	Stiff dogwood	Shrub	N		I	I
<i>Crataegus</i> sp. ³	Hawthorne	Tree	N	VR		R
<i>Croton glandulosus</i>	Tooth-leaved croton	Herb	N	VR		
<i>Cryptotaenia canadensis</i>	Honewort	Herb	N			I

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Cuscuta</i> sp. ³	Dodder	Vine	N		R	
<i>Cynodon dactylon</i>	Bermuda grass	Grass	E-Europe	I		
<i>Cyperus echinatus</i>	Globose flatsedge	Herb	N		I	
<i>Cyperus pseudovegetus</i>	Marsh flatsedge	Herb	N		F	
<i>Cyperus strigosus</i>	Straw-color flatsedge	Herb	N		F	
<i>Daucus carota</i>	Queen Anne's lace	Herb	N	C	S	
<i>Desmanthus illinoensis</i>	Prairie bundle-flower	Herb	N	S		
<i>Desmodium</i> sp. ³	Tick-trefoil	Herb	N	I		
<i>Dianthus armeria</i>	Deptford pink	Herb	E-Europe	R		
<i>Dichanthelium acuminatum</i>	Panic grass	Grass	N	R	I	
<i>Digitaria sanguinea</i>	Crab grass	Grass	E-Europe	I		

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Diodia virginiana</i>	Button-weed	Herb	N	VR		
<i>Dioscorea oppositifolia</i>	Cinnamon vine	Vine	E-Asia	S		R
<i>Dioscorea villosa</i>	Wild yam	Vine	N	R		S
<i>Diospyros virginiana</i>	Persimmon	Tree	N	R		
<i>Duchesnia indica</i>	Indian-strawberry	Herb	E-Asia			S
<i>Eleocharis obtusa</i>	Spike-rush	Herb	N		F	
<i>Elymus hystrix</i>	Bottlebrush grass	Grass	N			I
<i>Erechtites hieracifolia</i>	Fireweed	Herb	N		O	R
<i>Erigeron annuus</i>	Daisy fleabane	Herb	N	C	O	
<i>Erigeron philadelphicus</i>	Philadelphia fleabane	Herb	N	R		
<i>Eryngium prostratum</i>	Creeping coyote-thistle	Herb	N		R	

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Euonymus americanus</i>	American strawberrybush	Shrub	N			VR
<i>Euonymus fortunei</i>	Wintercreeper euonymus	Vine	E-Asia			VR
<i>Eupatorium capillifolium</i>	Dog-fennel	Herb	N	R		
<i>Eupatorium perfoliatum</i>	Boneset	Herb	N		I	
<i>Eupatorium serotinum</i> ³	Thoroughwort	Herb		R	C	
<i>Festuca arundinacea</i>	Meadow fescue	Grass	E-Eurasia	F		
<i>Fragaria virginiana</i>	Wild strawberry	Herb	N	VR		
<i>Fraxinus pennsylvanica</i>	Green ash	Tree	N	O	I	C
<i>Galium tinctorium</i>	Marsh bedstraw	Herb	N		I	
<i>Geranium carolinianum</i>	Carolina geranium	Herb	N	I		
<i>Geum canadense</i>	White avens	Herb	N			S

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Glechoma hederacea</i>	Gill-over-the-ground	Herb	E-Europe			I
<i>Gleditsia triacanthos</i>	Honeylocust	Tree	N			S
<i>Gnaphalium purpureum</i>	Purple cudweed	Herb	N	R	R	
<i>Gratiola</i> sp. ³	Hedgehyssop	Herb	H		F	
<i>Helenium amarum</i>	Sneezeweed	Herb	N	I		
<i>Hibiscus moscheutos</i>	Swamp rosemallow	Herb	N		R	VR
<i>Hordeum pusillum</i>	Little barley	Grass	N	I		
<i>Hypericum mutilum</i>	Slender St. John's-wort	Herb	N		O	
<i>Ilex decidua</i>	Deciduous holly	Shrub	N			S
<i>Impatiens capensis</i>	Jewelweed	Herb	N		O	I
<i>Ipomea pandurata</i>	Wild potato-vine	Vine	N	VR		

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Juglans nigra</i>	Black walnut	Tree	N	R		VR
<i>Juncus acuminatus</i>	Tapered rush	Herb	N		I	
<i>Juncus brachycarpus</i>	Short-fruited rush	Herb	N		R	
<i>Juncus coriaceous</i>	Leathery rush	Herb	N		VR	
<i>Juncus effusus</i>	Soft rush	Herb	N		O	
<i>Juncus marginatus</i>	Grass-leaf rush	Herb	N		VR	
<i>Juncus scirpoides</i>	Needle-pod rush	Herb	N		I	
<i>Juncus tenuis</i>	Path rush	Herb	N	S	C	R
<i>Juniperus virginiana</i>	Eastern redcedar	Tree	N	VR		
<i>Kummerowia striata</i>	Japanese-clover	Herb	E-Asia	VR		
<i>Lactuca canadensis</i>	Wild lettuce	Herb	N		VR	

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Lactuca serriola</i>	Prickly lettuce	Herb	E-Europe	I	R	
<i>Laportea canadensis</i>	Wood-nettle	Herb	N			I
<i>Lemna minor</i>	Lesser duckweed	Herb	N		S	
<i>Lepidium virginicum</i>	Poor-man's pepper	Herb	N	O		
<i>Lespedeza cuneata</i>	Sericea lespedeza	Herb	E-Asia	C		
<i>Ligustrum sinense</i>	Chinese privet	Shrub	E-Asia	I	F	C
<i>Liquidambar styraciflua</i>	Sweetgum	Tree	N	R	S	C
<i>Liriodendron tulipifera</i>	Yellow-poplar	Tree	N			O
<i>Lonicera japonica</i>	Japanese honeysuckle	Vine	E-Asia	F	O	O
<i>Lonicera maackii</i>	Amur honeysuckle	Shrub	E-Asia	S		
<i>Ludwigia alternifolia</i> ³	Bushy seedbox	Herb	N		F	

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Ludwigia palustris</i>	Marsh seedbox	Herb	N		F	
<i>Lycopus americanus</i>	American bugle-weed	Herb	N		O	
<i>Lysimachia nummularia</i>	Moneywort	Herb	E-Europe		O	R
<i>Maclura pomifera</i>	Osage-orange	Tree	E-South Central U.S.			VR
<i>Magnolia grandiflora</i>	Southern magnolia	Tree	E-S.E. Coastal Plain U.S.	VR		
<i>Matelea</i> sp. ³	Milkvine	Vine	N			VR
<i>Mecardonia acuminata</i>	Purple mecardonia	Herb	N		I	
<i>Medicago lupulina</i>	Black medic	Herb	E-Europe	I		
<i>Melilotus alba</i>	White sweetclover	Herb	E-Europe	F		

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Melilotus officinalis</i>	Yellow sweetclover	Herb	E-Europe	C		
<i>Melothria pendula</i>	Creeping cucumber	Vine	N			S
<i>Menispermum canadense</i>	Canada moonseed	Vine	N			S
<i>Mikania scandens</i>	Climbing hempweed	Vine	N		R	
<i>Morus alba</i>	White mulberry	Tree	E-Asia	R		VR
<i>Morus rubra</i>	Red mulberry	Tree	N			S
<i>Myosotis verna</i>	Spring forget-me-not	Herb	N			S
<i>Nyssa sylvatica</i>	Blackgum	Tree	N		S	
<i>Oenothera biennis</i>	Evening primrose	Herb	N	I	F	
<i>Oxalis dillenii</i>	Wood-sorrell	Herb	N	R		R
<i>Parthenocissus quinquefolia</i>	Virginia creeper	Vine	N		R	I

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Paspalum dilatatum</i>	Dallis grass	Grass	E-S. America	S		
<i>Passiflora incarnata</i>	Passion flower	Vine	N	S	R	
<i>Passiflora lutea</i>	Yellow passion-flower	Vine	N			VR
<i>Paulownia tomentosa</i>	Princesstree	Tree	E-Asia	VR	VR	
<i>Penthorum sedoides</i>	Ditch-stonecrop	Herb	N		O	
<i>Phyla lanceolata</i>	Lance-leaf frog-fruit	Herb	N		I	
<i>Physalis heterophylla</i>	Clammy groundcherry	Herb	N	R		
<i>Phytolacca americana</i>	Pokeweed	Herb	N	I	I	S
<i>Pilea pumila</i>	Clearweed	Herb	N			O
<i>Pinus taeda</i>	Loblolly pine	Tree	N	VR		

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Plantago aristata</i>	Bracted plantain	Herb	E-Western & Central U.S.	S		
<i>Plantago lanceolata</i>	English plantain	Herb	E-Europe	F		
<i>Plantago rugelii</i>	Rugel's plantain	Herb	N	R		
<i>Plantago virginiana</i>	Virginia plantain	Herb	N	VR		
<i>Platanus occidentalis</i>	Sycamore	Tree	N			O
<i>Pluchea camphorata</i>	Camphor-weed	Herb	N		O	
<i>Poa annua</i>	Annual bluegrass	Grass	E-Europe	R		
<i>Poa compressa</i>	Canada bluegrass	Grass	E-Europe	VR		
<i>Poa pratensis</i>	Kentucky bluegrass	Grass	E-Europe	R		
<i>Poa sylvestris</i>	Woodland bluegrass	Grass	N			S

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Polygonum aviculare</i>	Bird knotweed	Herb	N	R		
<i>Polygonum cuspidatum</i>	Japanese knotweed	Herb	E-Asia	VR		VR
<i>Polygonum persicaria</i>	Lady's thumb print	Herb	E-Europe		I	
<i>Polygonum virginianum</i>	Jumpseed	Herb	N			I
<i>Polygonum</i> sp. ³	Smartweed	Herb	N		O	
<i>Populus alba</i>	European white poplar	Tree	E-Europe	VR		
<i>Potentilla norvegica</i>	Norwegian cinquefoil	Herb	N		I	
<i>Prunus serotina</i>	Black cherry	Tree	N	S		R
<i>Ptelea trifoliata</i>	Wafer-ash	Shrub	N			R
<i>Pyrropappus carolinianus</i>	False dandelion	Herb	N	R		
<i>Pyrus calleryana</i>	Callery pear	Tree	E-Asia			VR

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Quercus alba</i>	White oak	Tree	N			VR
<i>Quercus falcata</i>	Southern red oak	Tree	N			I
<i>Quercus falcata</i> var. <i>pagodaefolia</i>	Cherrybark oak	Tree	E-S.E. Coastal Plain U.S.	R		S
<i>Quercus lyrata</i>	Overcup oak	Tree	N		S	R
<i>Quercus nigra</i>	Water oak	Tree	N	R		O
<i>Quercus phellos</i>	Willow oak	Tree	N		R	I
<i>Quercus shumardii</i>	Shumard oak	Tree	N			R
<i>Ranunculus abortivus</i>	Kidney-leaved buttercup	Herb				R
<i>Ranunculus sardous</i>	Buttercup	Herb	E-Europe	S	I	
<i>Rhus copallina</i>	Winged sumac	Shrub	N	S		

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Rhus glabra</i>	Smooth sumac	Shrub	N	S	R	
<i>Robinia pseudoacacia</i>	Black locust	Tree	N	R		S
<i>Rorippa islandica</i>	Yellow-cress	Herb	N		R	
<i>Rosa multiflora</i>	Multiflora rose	Shrub	E-Asia	R		R
<i>Rubus argutus</i>	Common blackberry	Herb	N	O	I	
<i>Rubus bifrons</i>	Himalaya-berry	Herb	E-Europe	R		
<i>Rumex conglomeratus</i>	Clustered dock	Herb	E-Europe	R	F	
<i>Rumex crispus</i>	Curly dock	Herb	E-Europe	I	I	
<i>Sagittaria</i> sp. ³	Arrow-head	Herb	N		R	
<i>Salix nigra</i>	Black willow	Tree	N	R	S	I
<i>Sambucus canadensis</i>	American elderberry	Shrub	N	VR	I	S

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Samolus parviflorus</i>	Water pimpernel	Herb	N		R	
<i>Sanicula</i> sp. ³	Sanicle	Herb	N			R
<i>Sassafras albidum</i>	Sassafras	Tree	N			R
<i>Saururus cernuus</i>	Lizard's tail	Herb	N		R	S
<i>Scirpus atrovirens</i>	Green bulrush	Herb	N		I	
<i>Senecio glabellus</i>	Butterweed	Herb	N		I	O
<i>Setaria glauca</i>	Yellow foxtail	Grass	E-Eurasia	I		
<i>Sida spinosa</i>	Prickly mallow	Herb	N		R	
<i>Sisyrinchium angustifolium</i>	Blue-eyed-grass	Herb	N	S		R
<i>Sisyrinchium fuscatum</i>	Sandplain blue-eyed-grass	Herb	N	VR		
<i>Smilax glauca</i>	Glaucous catbrier	Vine	N			S

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Smilax hispida</i>	Bristly greenbrier	Vine	N		R	I
<i>Smilax rotundifolia</i>	Common greenbrier	Vine	N		S	I
<i>Solanum americanum</i>	Black nightshade	Herb	N			R
<i>Solanum carolinense</i>	Horse-nettle	Herb	N	I		R
<i>Solidago canadensis</i>	Canada goldenrod	Herb	N	O		
<i>Solidago</i> sp. ³	Goldenrod	Herb	N			S
<i>Sonchus asper</i>	Sow-thistle	Herb	E-Europe	I	I	
<i>Sorghum halepense</i>	Johnson grass	Grass	E-Europe	O		
<i>Sphenopholis obtusata</i>	Prairie wedgegrass	Grass	N	I		
<i>Sporobolus indicus</i>	West Indian dropseed	Grass	E-Tropical Americas	R		

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Staphylea trifolia</i>	American bladdernut	Shrub	N			R
<i>Taraxacum officinale</i>	Common dandelion	Herb	E-Europe	R		
<i>Torilis japonica</i>	Japanese hedge parsley	Herb	E-Asia	VR		
<i>Toxicodendron radicans</i>	Poison-ivy	Vine	N	S	O	F
<i>Tradescantia subaspera</i>	Zig-zag spider-wort	Herb	N		I	I
<i>Tragopogon dubius</i>	Goat's beard	Herb	E-Europe		R	
<i>Tridens flavus</i>	Purpletop	Grass	N	O		
<i>Trifolium campestre</i>	Field clover	Herb	E-Europe	O		
<i>Trifolium pratense</i>	Red clover	Herb	E-Europe	I		
<i>Trifolium repens</i>	White clover	Herb	E-Europe	F		
<i>Triodanis perfoliata</i>	Round-leaved triodanis	Herb	N	S		

Table B-2

Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Triodanis biflora</i>	Venus' looking glass	Herb	N	O		
<i>Typha latifolia</i>	Common cattail	Herb	N		I	
<i>Ulmus alata</i>	Winged elm	Tree	N	R		
<i>Ulmus americana</i>	American elm	Tree	N	O	O	C
<i>Ulmus rubra</i>	Slippery elm	Tree	N			VR
<i>Valerianella radiata</i>	Corn-salad	Herb	N	I		
<i>Verbascum blattaria</i>	Moth mullein	Herb	E-Europe	S		
<i>Verbascum thapsus</i>	Common mullein	Herb	E-Europe	R	R	
<i>Verbena brasiliensis</i>	Brazilian vervain	Herb	E-S. America	VR		
<i>Verbesina</i> sp. ³	Wingstem	Herb	N		I	R
<i>Vernonia altissima</i> ³	Tall ironweed	Herb	N	VR	I	R

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Veronica arvensis</i>	Corn speedwell	Herb	E-Europe	I		
<i>Vicia angustifolia</i>	Narrow-leaved vetch	Vine	E-Europe	VR		
<i>Viola sororia</i>	Common blue violet	Herb	N		R	S
<i>Vitis cinerea</i>	Bailey's possum grape	Vine	N		R	S
<i>Vitis rotundifolia</i>	Muscadine grape	Vine	N			R
<i>Vitis vulpina</i>	Frost grape	Vine	N	I		S

Table B-2

**Flora Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
May 25-26, 1995
(continued)**

Scientific Name	Common Name	Life Form	Native/Exotic ¹	Site Occurrence/Abundance ²		
				Early Successional / Ruderal Community	Clearcut Wetland Community	Riparian Forest Community
<i>Wisteria sinense</i>	Chinese wisteria	Vine	E-Asia	VR		
<i>Xanthium strumarium</i>	Cocklebur	Herb	E-Europe	VR	R	

¹N = Native; E = Exotic.

²Abundance categories based on total frequency and coverage (after White, 1982).

VR = Very Rare: single population, few individuals

R = Rare: 1 or 2 locales, small populations

S = Scarce: several locales or scattered small populations

I = Infrequent: scattered locales throughout

O = Occasional: well distributed but not anywhere abundant

F = Frequent: generally encountered

C = Common: characteristic and dominant

³Tentative identification based on sterile material.

Table B-3

**Birds Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
December 14-15, 1995 and May 25-26, 1995**

Scientific Name	Common Name	Local Distribution	Nesting Status ²	Site Occurrence					
				Early Successional/ Ruderal Community		Clearcut Wetland Community		Riparian Forest Community	
				Fall	Spring	Fall	Spring	Fall	Spring
<i>Ardea herodias</i>	Great blue heron	YR	U				X		
<i>Bombycilla cedrorum</i>	Cedar waxwing	WR	U			X			
<i>Buteo jamaicensis</i>	Red-tailed hawk	YR	U		X	X			X
<i>Butorides striatus</i>	Green heron	YR	L				X		
<i>Cardinalis cardinalis</i>	Cardinal	YR	C	X	X	X		X	X
<i>Carpodacus mexicanus</i>	House finch	YR	C				X		
<i>Catharus guttatus</i>	Hermit thrush	WR	—					X	
<i>Ceryle alcyon</i>	Belted kingfisher	YR	L			X	X	X	
<i>Chaetura pelagica</i>	Chimney swift	SR	L				X		X
<i>Coccyzus americanus</i>	Yellow-billed cuckoo	SR	C		X				
<i>Colaptes auratus</i>	Northern flicker	YR	C	X		X			
<i>Columba livia</i>	Rock dove	YR	C				X		
<i>Corvus brachyrhynchos</i>	Crow	YR	L					X	X
<i>Cyanocitta cristata</i>	Blue jay	YR	C	X	X	X	X	X	X
<i>Dendroica pensylvanica</i>	Chestnut-sided warbler	SR	U						X
<i>Dryocopus pileatus</i>	Pileated woodpecker	YR	L				X		
<i>Dumetalla carolinensis</i>	Catbird	YR	C	X	X		X	X	X

Table B-3

**Birds Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
December 14-15, 1994 and May 25-26, 1995
(continued)**

Scientific Name	Common Name	Local Distribution	Nesting Status ²	Site Occurrence					
				Early Successional/ Ruderal Community		Clearcut Wetland Community		Riparian Forest Community	
				Fall	Spring	Fall	Spring	Fall	Spring
<i>Geothlypis trichas</i>	Common yellowthroat	SR	C				X		X
<i>Hirundo rustica</i>	Barn swallow	SR	C				X		
<i>Hylocichla mustelina</i>	Wood thrush	SR	C		X		X		X
<i>Icteria virens</i>	Yellow-breasted chat	SR	C				X		
<i>Melanerpes carolinus</i>	Red-bellied woodpecker	YR	C				X		X
<i>Melospiza georgiana</i>	Swamp sparrow	WR	—			X			
<i>Melospiza melodia</i>	Song sparrow	YR	C	X		X		X	X
<i>Mimus polyglottos</i>	Northern mockingbird	YR	C	X	X	X			
<i>Molothrus ater</i>	Brown headed cowbird	YR	C	X		X			
<i>Nycticorax violaceus</i>	Yellow-crowned night-heron	SR	U				X		
<i>Parus bicolor</i>	Tufted titmouse	YR	C	X			X	X	X
<i>Parus carolinensis</i>	Carolina chickadee	YR	C	X	X			X	X
<i>Passerina cyanea</i>	Indigo bunting	SR	C		X		X		
<i>Picoides pubescens</i>	Downy woodpecker	YR	C				X		X
<i>Picoides villosus</i>	Hairy woodpecker	YR	C		X				

Table B-3

**Birds Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
December 14-15, 1994 and May 25-26, 1995
(continued)**

Scientific Name	Common Name	Local Distribution	Nesting Status ²	Site Occurrence					
				Early Successional/ Ruderal Community		Clearcut Wetland Community		Riparian Forest Community	
				Fall	Spring	Fall	Spring	Fall	Spring
<i>Pipilo erythrophthalmus</i>	Rufous-sided towhee	YR	C	X	X		X	X	X
<i>Poliophtila caerulea</i>	Blue-gray gnatcatcher	SR	C				X		
<i>Protonotaria citrea</i>	Prothonotary warbler	SR	L						X
<i>Quiscalus quiscula</i>	Common grackle	YR	C		X		X		X
<i>Regulus calendula</i>	Ruby-crowned kinglet	WR	—	X				X	
<i>Sayornis phoebe</i>	Eastern phoebe	YR	C			X	X		
<i>Seiurus sp.</i>	Waterthrush	M	—						X
<i>Stelgidopteryx ruficollis</i>	Rough-winged swallow	SR	U				X		
<i>Strix varia</i>	Barred owl	YR	L				X	X	
<i>Sturnus vulgaris</i>	Starling	YR	C	X	X	X	X		
<i>Thryothorus ludovicianus</i>	Carolina wren	YR	C	X	X	X	X	X	X
<i>Toxostoma rufum</i>	Brown thrasher	SR	C	X		X	X		X
<i>Turdus migratorius</i>	Robin	YR	C	X	X	X	X	X	X
<i>Vireo flavifrons</i>	Yellow-throated vireo	SR	L			X			
<i>Vireo griseus</i>	White-eyed vireo	SR	C		X		X		
<i>Vireo olivaceus</i>	Red-eyed vireo	SR	C				X		X

Table B-3

**Birds Observed at the Tennessee Products Study Site
Chattanooga, Tennessee
December 14-15, 1994 and May 25-26, 1995
(continued)**

Scientific Name	Common Name	Local Distribution	Nesting Status ²	Site Occurrence					
				Early Successional/ Ruderal Community		Clearcut Wetland Community		Riparian Forest Community	
				Fall	Spring	Fall	Spring	Fall	Spring
<i>Zenaida macroura</i>	Mourning dove	YR	C	X		X	X		
<i>Zonotrichia albicollis</i>	White-throated sparrow	WR	—	X				X	

¹Local Distribution:

YR = Year-round resident

WR = Winter resident

SR = Summer resident

M = Seasonal migrant

²Nesting Status:

L = Likely

U = Unlikely

C = Confirmed

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table B-4

**Mammals Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee**

Scientific Name	Common Name	Likely	Unlikely	Confirmed	Site Occurrence		
					Early successional/ Ruderal	Clearcut Wetland	Riparian Forest
<i>Blarina brevicauda</i>	Eastern mole		✓				
<i>Canis latrans</i>	Coyote		✓				
<i>Castor canadensis</i>	Beaver			✓			X
<i>Cryptotis parva</i>	Short-tailed shrew	✓					
<i>Didelphis marsupialis</i>	Opossum			✓		X	
<i>Eptesicus fuscus</i>	Big brown bat	✓					
<i>Glaucomys volans</i>	Southern flying squirrel	✓					
<i>Lasionycteris noctivagans</i>	Silver-haired bat	✓					
<i>Lasiurus borealis</i>	Red bat	✓					
<i>Lasiurus cinereus</i>	Hoary bat	✓					
<i>Lutra canadensis</i>	River otter		✓				
<i>Marmota monax</i>	Woodchuck			✓	X		
<i>Mephitis mephitis</i>	Striped skunk	✓					

Table B-4

**Mammals Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee
(continued)**

Scientific Name	Common Name	Likely	Unlikely	Confirmed	Site Occurrence		
					Early successional/ Ruderal	Clearcut Wetland	Riparian Forest
<i>Microsorex hoyi</i>	Least shrew		✓				
<i>Microtus pennsylvanicus</i>	Meadow vole		✓				
<i>Mus musculus</i>	House mouse	✓					
<i>Mustela frenata</i>	Longtail weasel	✓					
<i>Mustela vison</i>	Mink	✓					
<i>Myotis grisescens</i>	Gray myotis		✓				
<i>Myotis lucifugus</i>	Little brown myotis	✓					
<i>Myotis sodalis</i>	Indiana myotis		✓				
<i>Myotis subulatus</i>	Small-footed myotis		✓				
<i>Napaeozapus insignis</i>	Woodland jumping mouse		✓				
<i>Neotoma floridana</i>	Eastern woodrat		✓				
<i>Nycticeius humeralis</i>	Evening bat	✓					

Table B-4

**Mammals Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee
(continued)**

Scientific Name	Common Name	Likely	Unlikely	Confirmed	Site Occurrence		
					Early successional/ Ruderal	Clearcut Wetland	Riparian Forest
<i>Odocoileus virginianus</i>	White-tailed deer		✓				
<i>Ondatra zibethica</i>	Muskrat			✓			X
<i>Oryzomys palustris</i>	Rice rat	✓					
<i>Peromyscus gossypinus</i>	Cotton mouse		✓				
<i>Peromyscus maniculatus</i>	Deer mouse	✓					
<i>Peromyscus leucopus</i>	White-footed mouse	✓					
<i>Peromyscus nuttalli</i>	Golden mouse	✓					
<i>Pipistrellus subflavus</i>	Eastern pipistrel	✓					
<i>Pitymys pinetorum</i>	Pine vole	✓					
<i>Plecotus rafinesquei</i>	Eastern big-eared bat		✓				
<i>Procyon lotor</i>	Raccoon			✓		X	X

Table B-4

**Mammals Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee
(continued)**

Scientific Name	Common Name	Likely	Unlikely	Confirmed	Site Occurrence		
					Early successional/ Ruderal	Clearcut Wetland	Riparian Forest
<i>Rattus norvegicus</i>	Norway rat	✓					
<i>Reithrodontomys humulis</i>	Eastern harvest mouse	✓					
<i>Scalopus aquaticus</i>	Keen myotis	✓					
<i>Sciurus niger</i>	Eastern fox squirrel	✓					
<i>Sciurus carolinensis</i>	Eastern gray squirrel			✓		X	X
<i>Sigmodon hispidus</i>	Hispid cotton rat		✓				
<i>Sorex cinereus</i>	Masked shrew	✓					
<i>Sorex longirostris</i>	Southeastern shrew	✓					
<i>Sorex fumeus</i>	Smoky shrew		✓				
<i>Spilogale putorius</i>	Spotted skunk	✓					
<i>Sylvilagus floridanus</i>	Eastern cottontail			✓	X		
<i>Tadarida brasiliensis</i>	Mexican freetail bat		✓				
<i>Tamias striatus</i>	Eastern chipmunk	✓					

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table B-4

**Mammals Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee
(continued)**

Scientific Name	Common Name	Likely	Unlikely	Confirmed	Site Occurrence		
					Early successional/ Ruderal	Clearcut Wetland	Riparian Forest
<i>Urocyon cinereoargenteus</i>	Gray fox	✓					
<i>Vulpes fulva</i>	Red fox	✓					
<i>Zapus hudsonius</i>	Meadow jumping mouse		✓				

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Table B-4

**Mammals Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee
(continued)**

Table B-5

**Reptiles and Amphibians Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee**

Scientific Name	Common Name	Likely	Unlikely	Confirmed	Site Occurrence			
					Early Successional/ Ruderal	Clearcut Wetland	Riparian Forest	
<i>Abmystoma tigrinum</i>	Eastern tiger salamander		✓					
<i>Acris crepitans</i>	Northern cricket frog	✓						
<i>Agkistrodon contortrix</i>	Northern copperhead		✓					
<i>Ambystoma opacum</i>	Marbled salamander	✓						
<i>Ambystoma maculatum</i>	Spotted salamander	✓						
<i>Anolis carolinensis</i>	Green anole		✓					

Table B-5

**Reptiles and Amphibians Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee
(continued)**

Scientific Name	Common Name	Likely	Unlikely	Confirmed	Site Occurrence			
					Early Successional/ Ruderal	Clearcut Wetland	Riparian Forest	
<i>Apadoe spinitera</i>	Eastern spiny softshell		✓					
<i>Bufo woodhousii</i>	Fowler's toad	✓						
<i>Bufo americanus</i>	American toad	✓						
<i>Carphophis amnenus</i>	Eastern worm snake	✓						
<i>Cemophora coccinea</i>	Northern scarlet snake		✓					
<i>Chelydra serpentina</i>	Common snapping turtle	✓						
<i>Chryserrys picta</i>	Midland painted turtle	✓						
<i>Coluber constrictor</i>	Northern black racer		✓					
<i>Crotalus horridus</i>	Timber rattlesnake		✓					

Table B-5

**Reptiles and Amphibians Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee
(continued)**

Scientific Name	Common Name	Likely	Unlikely	Confirmed	Site Occurrence			
					Early Successional/ Ruderal	Clearcut Wetland	Riparian Forest	
<i>Cryptobranchus atleghaniensis</i>	Hellbender		✓					
<i>Desmognathus monticola</i>	Seal salamander		✓					
<i>Desmognathus fuscus</i>	Northern/spotted dusky salamander	✓						
<i>Diadophis punctatus</i>	Northern ringneck snake	✓						
<i>Elaphe obsoleta</i>	Black/gray rat snake			✓			X	
<i>Enemidophorus sexlineatus</i>	Six-lined racerunner		✓					
<i>Ephisaurus attenuatus</i>	Eastern-slender glass lizard		✓					
<i>Eumeces fasciatus</i>	Fine-lined skink	✓						
<i>Eumeces laticeps</i>	Broadhead skink			✓	X			

Table B-5

**Reptiles and Amphibians Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee
(continued)**

Scientific Name	Common Name	Likely	Unlikely	Confirmed	Site Occurrence			
					Early Successional/ Ruderal	Clearcut Wetland	Riparian Forest	
<i>Eurycea longicauda</i>	Longtail salamander	✓						
<i>Eurycea cirrigera</i>	Southern two-lined salamander							
<i>Gastrophryne carolinensis</i>	Eastern narrowmouth toad							
<i>Graptemys geographica</i>	Common map turtle		✓					
<i>Gyrinophilus porphyriticus</i>	Northern spring salamander		✓					
<i>Hemidoctylium scutatum</i>	Four-toed salamander		✓					
<i>Heterodon platirhinos</i>	Eastern hognose snake	✓						
<i>Hyla versicolor/chrysocelis</i>	Gray treefrog	✓						

Table B-5

**Reptiles and Amphibians Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee
(continued)**

Scientific Name	Common Name	Likely	Unlikely	Confirmed	Site Occurrence			
					Early Successional/ Ruderal	Clearcut Wetland	Riparian Forest	
<i>Kinosternon subrubrum</i>	Eastern mud turtle	✓						
<i>Lampropeltis getula</i>	Black kingsnake	✓						
<i>Lampropeltis triangulum</i>	Eastern milksnake/Scarlet kingsnake	✓						
<i>Lampropeltis calligaster</i>	Mole kingsnake		✓					
<i>Necturus maculosus</i>	Mudpuppy		✓					
<i>Nerodia sipedon</i>	Northern/Midland water snake	✓						
<i>Notophthalmus viridescens</i>	Red-spotted newt	✓						
<i>Opheodrys aestivus</i>	Rough green snake	✓						
<i>Pituophis melanoleucus</i>	Northern pine snake		✓					

Table B-5

**Reptiles and Amphibians Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee
(continued)**

Scientific Name	Common Name	Likely	Unlikely	Confirmed	Site Occurrence			
					Early Successional/ Ruderal	Clearcut Wetland	Riparian Forest	
<i>Plethodon glutinosus</i>	Northern slimy salamander	✓						
<i>Pseudacris triseriata</i>	Upland chorus frog	✓						
<i>Pseudacris crucifer</i>	Northern spring peeper	✓						
<i>Pseudemys concinna</i>	Hieroglyphic river cooter		✓					
<i>Pseudotriton montosus</i>	Midland mud salamander		✓					
<i>Pseudotriton ruber</i>	Northern red salamander	✓						
<i>Rana clamitans</i>	Green frog	✓						
<i>Rana utricularia</i>	Southern leopard frog	✓						
<i>Rana catesbeiana</i>	Bullfrog	✓						

Table B-5

**Reptiles and Amphibians Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee
(continued)**

Scientific Name	Common Name	Likely	Unlikely	Confirmed	Site Occurrence			
					Early Successional/ Ruderal	Clearcut Wetland	Riparian Forest	
<i>Rana palustris</i>	Pickerel frog	✓						
<i>Rana sylvatica</i>	Wood frog	✓						
<i>Regina septemvittata</i>	Queen snake	✓						
<i>Scaphiopus holbrookii</i>	Eastern spadefoot	✓						
<i>Scincella lateralis</i>	Ground skink	✓						
<i>Scoloporus undulatus</i>	Northern fence lizard		✓					
<i>Sternotherus minor</i>	stripeneck musk turtle							
<i>Sternotherus odoratus</i>	Common musk turtle		✓					
<i>Storeria dekayi</i>	Northern/Midland brown snake	✓						

Table B-5

**Reptiles and Amphibians Known or Likely to Occur at the Tennessee Products Site
Chattanooga, Tennessee
(continued)**

Scientific Name	Common Name	Likely	Unlikely	Confirmed	Site Occurrence			
					Early Successional/ Ruderal	Clearcut Wetland	Riparian Forest	
<i>Storeria occipitomaculata</i>	Northern redbelly snake		✓					
<i>Terrapene carolina</i>	Eastern box turtle			✓		X		
<i>Thamnophis sirtalis</i>	Eastern garter snake	✓						
<i>Thamnophis sauritus</i>	Eastern ribbon snake		✓					
<i>Trachemys scripta</i>	Yellow bellied slider	✓						
<i>Virginia valeriae</i>	Eastern earthsnake		✓					

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Appendix c
Revision: 0
Date: April 1996

APPENDIX C

CALCULATION OF CHEMICAL CONCENTRATIONS IN EARTHWORMS

Appendix C

Calculation of Chemical Concentrations in Earthworms

Calculation of chemical concentrations in earthworms were determined by multiplying chemical-specific bioaccumulation factors (BAFs) by chemical concentrations found in soils. Accumulation of chemicals in earthworms is dependent on numerous site-specific factors: soil type, pH, soil organic content, and earthworm species. When two or more BAFs were available for a specific chemical, the BAF determined at conditions most similar to those at the site was selected. If experimental soil conditions were unavailable for comparison to known soil conditions, then an average BAF for a given chemical at soil concentrations similar to those found at the site was selected (Beyer and Cromartie, 1987). BAFs were calculated in the experimental studies by dividing the concentration detected in the earthworm by the concentration measured in soil; the ratio is expressed as follows:

$$BAF = \frac{\text{Earthworm concentration}}{\text{Soil concentration}}$$

The ingestion rates used for birds and mammals are in dry weight (i.e., grams dry weight diet/day); therefore, BAFs which were calculated based on earthworm and soil wet weight have been converted to dry weight by multiplying wet weight BAFs by 4 (Beyer and Gish, 1980). The chemical-specific BAFs and their sources are presented in Table C-1. The estimated earthworm concentrations are presented in Tables C-2 and C-3 for the Tar Dump and Hamill Road Dump #3, respectively.

Table C-1
Earthworm Bioaccumulation Factors (BAFs)
for Chemicals of Potential Concern
Tennessee Products Site, Chattanooga, TN

Chemical	BAF	Source
Organics		
Acetone	NC	--
Aldrin	3.30E+00	Gish, 1970
alpha-BHC •	1.01E+01	Wheatley and Hardman, 1968
beta-BHC •	1.01E+01	Wheatley and Hardman, 1968
delta-BHC •	1.01E+01	Wheatley and Hardman, 1968
gamma-BHC	1.01E+01	Wheatley and Hardman, 1968
Bis(2-ethylhexyl)phthalate	NC	--
Carbazole	NC	--
alpha-Chlordane	5.00E+00	Gish, 1970
gamma-Chlordane	5.00E+00	Gish, 1970
DDD	8.30E+00	Gish, 1970
DDT	1.06E+01	Gish, 1970
Dibenzofuran	NC	--
Dieldrin	9.90E+00	Gish, 1970
Endosulfan I	NC	--
Endosulfan II	NC	--
Endosulfan sulfate	NC	--
Endrin	3.60E+00	Gish, 1970
Endrin aldehyde	NC	--
Heptachlor	NC	--
Heptachlor epoxide	3.00E+00	Gish, 1970
Hexachlorobenzene	NC	--
Methoxychlor	2.80E+01	Thompson, 1973
2-Methylnaphthalene	NC	--
Naphthalene	2.10E-01	Beyer and Stafford, 1993
PAHs		
Acenaphthylene	2.20E-01	Beyer and Stafford, 1993
Anthracene	3.20E-01	Beyer and Stafford, 1993
Benzo(a)anthracene	2.70E-01	Beyer and Stafford, 1993
Benzo(a)pyrene	3.40E-01	Beyer and Stafford, 1993
Benzo(b and/or k)fluoranthene	2.10E-01	Beyer and Stafford, 1993
Benzo(g,h,i)perylene	1.50E-01	Beyer and Stafford, 1993
Chrysene	4.40E-01	Beyer and Stafford, 1993
Dibenzo(a,h)anthracene	4.90E-01	Beyer and Stafford, 1993
Fluoranthene	3.70E-01	Beyer and Stafford, 1993
Indeno(1,2,3-cd)pyrene	4.10E-01	Beyer and Stafford, 1993
Phenanthrene	2.80E-01	Beyer and Stafford, 1993
Pyrene	3.90E-01	Beyer and Stafford, 1993
Styrene	NC	--
Tetrachloroethene	NC	--
1,1,1-Trichloroethane	NC	--
Trichloroethylene	NC	--
Xylenes (total)	NC	--
Inorganics		
Aluminum	3.40E-01	Beyer and Stafford, 1993
Arsenic	4.80E-02	Beyer and Cromartie, 1987
Barium	3.60E-01	Beyer and Stafford, 1993
Beryllium	NC	--
Cadmium	4.60E+00	Beyer and Stafford, 1993
Chromium (total)	7.70E-01	Beyer and Cromartie, 1987
Cobalt	NC	--
Copper	4.40E-01	Beyer and Cromartie, 1987
Iron	3.80E-01	Beyer and Stafford, 1993
Lead	5.30E-01	Beyer and Cromartie, 1987
Manganese	1.10E-01	Kabata-Pendias and Pendias, 1984
Mercury	3.65E-01	Kabata-Pendias and Pendias, 1984
Nickel	1.80E+00	Kabata-Pendias and Pendias, 1984
Selenium	NC	--
Silver	NC	--
Strontium	4.20E-01	Beyer and Stafford, 1993
Titanium	NC	--
Vanadium	NC	--
Zinc	9.90E+00	Beyer and Cromartie, 1987
Cyanide	NC	--

NC = Not calculated due to the lack of appropriate accumulation data.
 • BAF based on gamma-BHC.

Table C-2
Estimation of Earthworm Concentrations
Tar Dump
Tennessee Products Site, Chattanooga, TN

Chemical	Maximum Exposure Concentration * (mg/kg)	Bioaccumulation Factor	Concentration in Earthworms (mg/kg)
Organics			
Acetone	9.00E+01	NC	NC
Aldrin	2.80E-03	3.30E+00	9.24E-03
alpha - BHC	1.22E+00	1.01E+01	1.24E+01
beta-BHC	1.22E+00	1.01E+01	1.23E+01
delta-BHC	5.10E-01	1.01E+01	5.15E+00
gamma-BHC	4.27E-01	1.01E+01	4.31E+00
Carbazole	4.40E-01	NC	NC
alpha-Chlordane	3.60E-02	5.00E+00	1.80E-01
gamma-Chlordane	3.12E-02	5.00E+00	1.56E-01
DDD	2.57E-02	8.30E+00	2.13E-01
DDT	7.80E-03	1.06E+01	8.27E-02
Dibenzofuran	1.00E-01	NC	NC
Dieldrin	3.90E+00	9.90E+00	3.86E+01
Endosulfan I	1.00E-01	NC	NC
Endosulfan II	7.07E-02	NC	NC
Endrin	3.78E-02	3.60E+00	1.36E-01
Endrin aldehyde	4.41E-02	NC	NC
Heptachlor	3.00E-01	NC	NC
Heptachlor epoxide	7.36E-02	3.00E+00	2.21E-01
Hexachlorobenzene	5.80E-01	NC	NC
Methoxychlor	9.90E-02	2.80E+01	2.77E+00
2-Methylnaphthalene	1.80E-01	NC	NC
Naphthalene	4.60E-01	2.10E-01	9.66E-02
PAHs			
Acenaphthylene	1.68E+00	2.20E-01	3.69E-01
Anthracene	1.36E+00	3.20E-01	4.36E-01
Benzo(a)anthracene	1.54E+01	2.70E-01	4.15E+00
Benzo(a)pyrene	2.23E+01	3.40E-01	7.60E+00
Benzo(b and/or k)fluoranthene	3.53E+01	2.10E-01	7.41E+00
Benzo(g,h,i)perylene	8.86E+00	1.50E-01	1.33E+00
Chrysene	1.59E+01	4.40E-01	6.99E+00
Dibenzo(a,h)anthracene	6.39E+00	4.90E-01	3.13E+00
Fluoranthene	2.05E+01	3.70E-01	7.58E+00
Indeno(1,2,3-cd)pyrene	1.23E+01	4.10E-01	5.04E+00
Phenanthrene	3.90E+00	2.80E-01	1.09E+00
Pyrene	1.62E+01	3.90E-01	6.33E+00
Tetrachloroethene	4.00E-03	NC	NC
1,1,1-Trichloroethane	8.00E-03	NC	NC
Trichloroethylene	3.00E-03	NC	NC
Xylenes (total)	1.00E-03	NC	NC
Inorganics			
Aluminum	1.14E+04	3.40E-01	3.87E+03
Arsenic	9.52E+00	4.80E-02	4.57E-01
Barium	1.17E+02	3.60E-01	4.20E+01
Beryllium	9.70E-01	NC	NC
Cadmium	3.70E-01	4.60E+00	1.70E+00
Chromium (total)	1.83E+02	7.70E-01	1.41E+02
Cobalt	2.01E+01	NC	NC
Copper	2.87E+01	4.40E-01	1.26E+01
Iron	1.87E+04	3.80E-01	7.10E+03
Lead	8.27E+01	5.30E-01	4.39E+01
Manganese	8.13E+02	1.10E-01	8.95E+01
Mercury	7.90E-01	3.65E-01	2.88E-01
Nickel	3.20E+01	1.80E+00	5.76E+01
Selenium	7.30E-01	NC	NC
Silver	4.05E+00	NC	NC
Vanadium	2.20E+01	NC	NC
Zinc	1.76E+02	9.90E+00	1.74E+03
Cyanide	3.60E-01	NC	NC

NC = Not calculated due to the lack of appropriate accumulation data.
 * Maximum soil exposure concentrations from 0 to 2 feet deep.

Table C-3
Estimation of Earthworm Concentrations
Hamill Road Dump #3
Tennessee Products Site, Chattanooga, TN

Chemical	Maximum Exposure Concentration * (mg/kg)	Bioaccumulation Factor	Concentration in Earthworms (mg/kg)
Organics			
Aldrin	1.30E-03	3.30E+00	4.29E-03
beta-BHC	3.80E-01	1.01E+01	3.84E+00
delta-BHC	9.30E-02	1.01E+01	9.39E-01
gamma-BHC	1.10E-01	1.01E+01	1.11E+00
Carbazole	5.50E-01	NC	NC
alpha-Chlordane	1.90E-03	5.00E+00	9.50E-03
DDT	4.40E-02	1.06E+01	4.66E-01
Dibenzofuran	1.80E-01	NC	NC
Dieldrin	3.40E-01	9.90E+00	3.37E+00
Endosulfan I	2.00E-01	NC	NC
Endosulfan II	5.40E-02	NC	NC
Endosulfan sulfate	3.10E-02	NC	NC
Endrin	3.20E-02	3.60E+00	1.15E-01
Heptachlor	9.20E-02	NC	NC
Hexachlorobenzene	2.82E-02	NC	NC
2-Methylnaphthalene	8.20E-02	NC	NC
Naphthalene	3.40E-01	2.10E-01	7.14E-02
PAHs			
Acenaphthylene	1.60E+00	2.20E-01	3.52E-01
Anthracene	1.58E+00	3.20E-01	5.07E-01
Benzo(a)anthracene	2.00E+01	2.70E-01	5.40E+00
Benzo(a)pyrene	1.90E+01	3.40E-01	6.46E+00
Benzo(b and/or k)fluoranthene	4.50E+01	2.10E-01	9.45E+00
Benzo(g,h,i)perylene	4.00E+00	1.50E-01	6.00E-01
Chrysene	2.30E+01	4.40E-01	1.01E+01
Dibenzo(a,h)anthracene	5.00E+00	4.90E-01	2.45E+00
Fluoranthene	3.90E+01	3.70E-01	1.44E+01
Indeno(1,2,3-cd)pyrene	1.30E+01	4.10E-01	5.33E+00
Phenanthrene	5.70E+00	2.80E-01	1.60E+00
Pyrene	3.70E+01	3.90E-01	1.44E+01
Styrene	6.84E-03	NC	NC
1,1,1-Trichloroethane	1.90E-02	NC	NC
Xylenes (total)	3.00E-03	NC	NC
Inorganics			
Aluminum	1.53E+04	3.40E-01	5.20E+03
Arsenic	1.01E+01	4.80E-02	4.85E-01
Barium	1.25E+02	3.60E-01	4.49E+01
Beryllium	9.90E-01	NC	NC
Chromium (total)	4.78E+01	7.70E-01	3.68E+01
Cobalt	1.80E+01	NC	NC
Copper	2.86E+01	4.40E-01	1.26E+01
Iron	2.10E+04	3.80E-01	7.98E+03
Lead	4.68E+01	5.30E-01	2.48E+01
Manganese	2.00E+03	1.10E-01	2.20E+02
Mercury	2.20E-01	3.65E-01	8.03E-02
Nickel	2.40E+01	1.80E+00	4.33E+01
Selenium	2.09E+00	NC	NC
Vanadium	2.60E+01	NC	NC
Zinc	9.35E+01	9.90E+00	9.25E+02
Cyanide	6.40E-01	NC	NC

NC = Not calculated due to the lack of appropriate accumulation data.

* Maximum soil exposure concentrations from 0 to 2 feet deep.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Appendix D
Revision: 0
Date: April 1996

APPENDIX D

**CALCULATION OF CHEMICAL CONCENTRATIONS
IN PLANT SEEDS**

Appendix D

Calculation of Chemical Concentrations in Seeds

Chemical concentrations in seeds resulting from the uptake of chemicals from the soil were calculated using the following equation:

$$C_{seed} = C_{soil} \times PUF$$

Where:

C_{seed} = Chemical concentration in seed (mg/kg dry weight seed)

C_{soil} = Chemical concentration in soil (mg/kg dry weight soil)

PUF = Plant uptake factor (chemical-specific factor; unitless)

Plant uptake factors (PUFs) for organics were estimated using the relationship presented by Travis and Arms (1988):

$$PUF = 38.7 \times Kow^{-0.578}$$

Where:

PUF = Plant uptake factor (chemical-specific; unitless)

Kow = Octanol-water partition coefficient (chemical-specific)

For inorganics, transfer coefficients developed by Baes et al. (1984) for reproductive portions of plants were used to calculate concentrations of inorganic chemicals in seeds. The PUFs are reported in dry weight. The chemical-specific PUFs, Kows, and their sources are presented in Table D-1. The estimated plant seed concentrations are presented in Tables D-2 and D-3 for the Tar Dump and Hamill Road Dump #3, respectively.

Table D-1
Plant Uptake Factors (PUFs) for Chemicals of Potential Concern
Tennessee Products Site, Chattanooga, TN

Chemical	B ₁ Transfer Coefficient	Source	Log K _{ow}	Source	Plant Uptake Factor
Organics					
Acetone	NA	--	-0.24	EHRV, 1996	5.33E+01
Aldrin	NA	--	3.01	EHRV, 1996	7.05E-01
alpha-BHC	NA	--	3.90	EHRV, 1996	2.16E-01
beta-BHC	NA	--	3.90	EHRV, 1996	2.16E-01
delta-BHC	NA	--	4.10	EHRV, 1996	1.65E-01
gamma-BHC	NA	--	3.90	EHRV, 1996	2.16E-01
Bis(2-ethylhexyl)phthalate	NA	--	5.11	EHRV, 1996	4.31E-02
Carbazole	NA	--	3.29	Verschuere, 1983	4.86E-01
alpha-Chlordane	NA	--	2.78	EPA, 1987	9.58E-01
gamma-Chlordane	NA	--	2.78	EPA, 1987	9.58E-01
DDD	NA	--	5.99	EPA, 1992e	1.34E-02
DDT	NA	--	4.89	EPA, 1987	5.78E-02
Dibenzofuran	NA	--	4.17	EHRV, 1996	1.51E-01
Dieldrin	NA	--	3.54	EHRV, 1996	3.48E-01
Endosulfan I	NA	--	3.55	EHRV, 1996	3.44E-01
Endosulfan II	NA	--	3.62	EHRV, 1996	3.13E-01
Endosulfan sulfate	NA	--	3.89	EHRV, 1996	2.19E-01
Endrin	NA	--	5.60	EHRV, 1996	2.24E-02
Endrin aldehyde	NA	--	5.60	EHRV, 1996	2.24E-02
Heptachlor	NA	--	4.40	EHRV, 1996	1.11E-01
Heptachlor epoxide	NA	--	2.70	EHRV, 1996	1.07E+00
Hexachlorobenzene	NA	--	5.50	EHRV, 1996	2.56E-02
Methoxychlor	NA	--	4.30	EHRV, 1996	1.27E-01
2-Methylnaphthalene	NA	--	4.11	EHRV, 1996	1.63E-01
Naphthalene	NA	--	3.36	EHRV, 1996	4.43E-01
PAHs					
Acenaphthylene	NA	--	3.72	EHRV, 1996	2.74E-01
Anthracene	NA	--	4.54	EHRV, 1996	9.20E-02
Benzo(a)anthracene	NA	--	5.61	EHRV, 1996	2.22E-02
Benzo(a)pyrene	NA	--	6.25	EHRV, 1996	9.45E-03
Benzo(b and/or k)fluoranthene	NA	--	6.06	EHRV, 1996	1.22E-02
Benzo(g,h,i)perylene	NA	--	6.51	EHRV, 1996	6.69E-03
Chrysene	NA	--	5.61	EHRV, 1996	2.22E-02
Dibenzo(a,h)anthracene	NA	--	5.60	EHRV, 1996	2.24E-02
Fluoranthene	NA	--	5.20	EHRV, 1996	3.82E-02
Indeno(1,2,3-cd)pyrene	NA	--	6.51	EHRV, 1996	6.69E-03
Phenanthrene	NA	--	4.52	EHRV, 1996	9.45E-02
Pyrene	NA	--	5.18	EHRV, 1996	3.93E-02
Styrene	NA	--	3.16	EHRV, 1996	5.77E-01
Tetrachloroethene	NA	--	2.53	EHRV, 1996	1.34E+00
1,1,1-Trichloroethane	NA	--	2.47	EHRV, 1996	1.45E+00
Trichloroethylene	NA	--	2.42	EHRV, 1996	1.55E+00
Xylenes (total)	NA	--	3.20	EPA, 1992e	5.48E-01
Inorganics					
Aluminum	6.50E-04	Baes et al., 1984	NA	--	6.50E-04
Arsenic	6.00E-03	Baes et al., 1984	NA	--	6.00E-03
Barium	1.50E-02	Baes et al., 1984	NA	--	1.50E-02
Beryllium	1.50E-03	Baes et al., 1984	NA	--	1.50E-03
Cadmium	1.50E-01	Baes et al., 1984	NA	--	1.50E-01
Chromium (total)	4.50E-03	Baes et al., 1984	NA	--	4.50E-03
Cobalt	7.00E-03	Baes et al., 1984	NA	--	7.00E-03
Copper	2.50E-01	Baes et al., 1984	NA	--	2.50E-01
Iron	1.00E-03	Baes et al., 1984	NA	--	1.00E-03
Lead	9.00E-03	Baes et al., 1984	NA	--	9.00E-03
Manganese	5.00E-02	Baes et al., 1984	NA	--	5.00E-02
Mercury	2.00E-01	Baes et al., 1984	NA	--	2.00E-01
Nickel	6.00E-02	Baes et al., 1984	NA	--	6.00E-02
Selenium	2.50E-02	Baes et al., 1984	NA	--	2.50E-02
Silver	1.00E-01	Baes et al., 1984	NA	--	1.00E-01
Strontium	2.50E-01	Baes et al., 1984	NA	--	2.50E-01
Titanium	3.00E-03	Baes et al., 1984	NA	--	3.00E-03
Vanadium	3.00E-03	Baes et al., 1984	NA	--	3.00E-03
Zinc	9.00E-01	Baes et al., 1984	NA	--	9.00E-01
Cyanide	NA	--	NA	Wallace et al., 1977	1.35E+00

NA = Not available.

Table D-2
Estimation of Seed Concentrations
Tar Dump
Tennessee Products Site, Chattanooga, TN

Chemical	Maximum Exposure Concentration - (mg/kg)	Plant Uptake Factor: Reproductive Portions	Concentration in Seeds (mg/kg)
Organics			
Acetone	9.00E+01	5.33E+01	4.80E+03
Aldrin	2.80E-03	7.05E-01	1.97E-03
alpha - BHC	1.22E+00	2.16E-01	2.64E-01
beta-BHC	1.22E+00	2.16E-01	2.63E-01
delta-BHC	5.10E-01	1.65E-01	8.43E-02
gamma-BHC	4.27E-01	2.16E-01	9.20E-02
Carbazole	4.40E-01	4.86E-01	2.14E-01
alpha-Chlordane	3.60E-02	9.58E-01	3.45E-02
gamma-Chlordane	3.12E-02	9.58E-01	2.99E-02
DDD	2.57E-02	1.34E-02	3.43E-04
DDT	7.80E-03	5.78E-02	4.50E-04
Dibenzofuran	1.00E-01	1.51E-01	1.51E-02
Dieldrin	3.90E+00	3.48E-01	1.36E+00
Endosulfan I	1.00E-01	3.44E-01	3.44E-02
Endosulfan II	7.07E-02	3.13E-01	2.21E-02
Endrin	3.78E-02	2.24E-02	8.49E-04
Endrin aldehyde	4.41E-02	2.24E-02	9.90E-04
Heptachlor	3.00E-01	1.11E-01	3.33E-02
Heptachlor epoxide	7.36E-02	1.07E+00	7.84E-02
Hexachlorobenzene	5.80E-01	2.56E-02	1.49E-02
Methoxychlor	9.90E-02	1.27E-01	1.25E-02
2-Methylnaphthalene	1.80E-01	1.63E-01	2.94E-02
Naphthalene	4.60E-01	4.43E-01	2.04E-01
PAHs			
Acenaphthylene	1.68E+00	2.74E-01	4.59E-01
Anthracene	1.36E+00	9.20E-02	1.25E-01
Benzo(a)anthracene	1.54E+01	2.22E-02	3.41E-01
Benzo(a)pyrene	2.23E+01	9.45E-03	2.11E-01
Benzo(b and/or k)fluoranthene	3.53E+01	1.22E-02	4.29E-01
Benzo(g,h,i)perylene	8.86E+00	6.69E-03	5.92E-02
Chrysene	1.59E+01	2.22E-02	3.52E-01
Dibenzo(a,h)anthracene	6.39E+00	2.24E-02	1.43E-01
Fluoranthene	2.05E+01	3.82E-02	7.83E-01
Indeno(1,2,3-cd)pyrene	1.23E+01	6.69E-03	8.22E-02
Phenanthrene	3.90E+00	9.45E-02	3.68E-01
Pyrene	1.62E+01	3.93E-02	6.37E-01
Tetrachloroethene	4.00E-03	1.34E+00	5.34E-03
1,1,1-Trichloroethane	8.00E-03	1.45E+00	1.16E-02
Trichloroethylene	3.00E-03	1.55E+00	4.64E-03
Xylenes (total)	1.00E-03	5.48E-01	5.48E-04
Inorganics			
Aluminum	1.14E+04	6.50E-04	7.40E+00
Arsenic	9.52E+00	6.00E-03	5.71E-02
Barium	1.17E+02	1.50E-02	1.75E+00
Beryllium	9.70E-01	1.50E-03	1.46E-03
Cadmium	3.70E-01	1.50E-01	5.55E-02
Chromium (total)	1.83E+02	4.50E-03	8.25E-01
Cobalt	2.01E+01	7.00E-03	1.40E-01
Copper	2.87E+01	2.50E-01	7.18E+00
Iron	1.87E+04	1.00E-03	1.87E+01
Lead	8.27E+01	9.00E-03	7.45E-01
Manganese	8.13E+02	5.00E-02	4.07E+01
Mercury	7.90E-01	2.00E-01	1.58E-01
Nickel	3.20E+01	6.00E-02	1.92E+00
Selenium	7.30E-01	2.50E-02	1.83E-02
Silver	4.05E+00	1.00E-01	4.05E-01
Vanadium	2.20E+01	3.00E-03	6.61E-02
Zinc	1.76E+02	9.00E-01	1.58E+02
Cyanide	3.60E-01	1.35E+00	4.86E-01

• Maximum soil exposure concentrations from 0 to 2 feet deep.

Table D-3
Estimation of Seed Concentrations
Hamill Road Dump #3
Tennessee Products Site, Chattanooga, TN

Chemical	Maximum Exposure Concentration • (mg/kg)	Plant Uptake Factor: Reproductive Portions	Concentration in Seeds (mg/kg)
<i>Organics</i>			
Aldrin	1.30E-03	7.05E-01	9.17E-04
beta-BHC	3.80E-01	2.16E-01	8.20E-02
delta-BHC	9.30E-02	1.65E-01	1.54E-02
gamma-BHC	1.10E-01	2.16E-01	2.37E-02
Carbazole	5.50E-01	4.86E-01	2.67E-01
alpha-Chlordane	1.90E-03	9.58E-01	1.82E-03
DDT	4.40E-02	5.78E-02	2.54E-03
Dibenzofuran	1.80E-01	1.51E-01	2.71E-02
Dieldrin	3.40E-01	3.48E-01	1.18E-01
Endosulfan I	2.00E-01	3.44E-01	6.87E-02
Endosulfan II	5.40E-02	3.13E-01	1.69E-02
Endosulfan sulfate	3.10E-02	2.19E-01	6.78E-03
Endrin	3.20E-02	2.24E-02	7.18E-04
Heptachlor	9.20E-02	1.11E-01	1.02E-02
Hexachlorobenzene	2.82E-02	2.56E-02	7.22E-04
2-Methylnaphthalene	8.20E-02	1.63E-01	1.34E-02
Naphthalene	3.40E-01	4.43E-01	1.50E-01
<i>PAHs</i>			
Acenaphthylene	1.60E+00	2.74E-01	4.38E-01
Anthracene	1.58E+00	9.20E-02	1.46E-01
Benzo(a)anthracene	2.00E+01	2.22E-02	4.43E-01
Benzo(a)pyrene	1.90E+01	9.45E-03	1.80E-01
Benzo(b and/or k)fluoranthene	4.50E+01	1.22E-02	5.48E-01
Benzo(g,h,i)perylene	4.00E+00	6.69E-03	2.67E-02
Chrysene	2.30E+01	2.22E-02	5.10E-01
Dibenzo(a,h)anthracene	5.00E+00	2.24E-02	1.12E-01
Fluoranthene	3.90E+01	3.82E-02	1.49E+00
Indeno(1,2,3-cd)pyrene	1.30E+01	6.69E-03	8.69E-02
Phenanthrene	5.70E+00	9.45E-02	5.39E-01
Pyrene	3.70E+01	3.93E-02	1.45E+00
Styrene	6.84E-03	5.77E-01	3.95E-03
1,1,1-Trichloroethane	1.90E-02	1.45E+00	2.75E-02
Xylenes (total)	3.00E-03	5.48E-01	1.64E-03
<i>Inorganics</i>			
Aluminum	1.53E+04	6.50E-04	9.94E+00
Arsenic	1.01E+01	6.00E-03	6.06E-02
Barium	1.25E+02	1.50E-02	1.87E+00
Beryllium	9.90E-01	1.50E-03	1.49E-03
Chromium (total)	4.78E+01	4.50E-03	2.15E-01
Cobalt	1.80E+01	7.00E-03	1.26E-01
Copper	2.86E+01	2.50E-01	7.16E+00
Iron	2.10E+04	1.00E-03	2.10E+01
Lead	4.68E+01	9.00E-03	4.21E-01
Manganese	2.00E+03	5.00E-02	1.00E+02
Mercury	2.20E-01	2.00E-01	4.40E-02
Nickel	2.40E+01	6.00E-02	1.44E+00
Selenium	2.09E+00	2.50E-02	5.23E-02
Vanadium	2.60E+01	3.00E-03	7.80E-02
Zinc	9.35E+01	9.00E-01	8.41E+01
Cyanide	6.40E-01	1.35E+00	8.64E-01

• Maximum soil exposure concentrations from 0 to 2 feet deep.

This document was prepared by Roy F. Weston, Inc., expressly for EPA. It shall not be disclosed, in whole or in part, without the express written permission of EPA.

Ecological Risk Assessment
Tennessee Products Site
Section: Appendix E
Revision: 1
Date: April 1999

APPENDIX E

SUPPLEMENTAL INVESTIGATION FOR THE ECOLOGICAL RISK ASSESSMENT OF THE CHATTANOOGA CREEK/TENNESSEE PRODUCTS SUPERFUND SITE, CHATTANOOGA, TN, FEBRUARY, 1999

SUPPLEMENTAL INVESTIGATION FOR THE ECOLOGICAL RISK ASSESSMENT OF THE
CHATTANOOGA CREEK/TENNESSEE PRODUCTS SUPERFUND SITE
CHATTANOOGA, TN
FEBRUARY 1999

U.S. EPA Work Assignment No.: 3-335
Weston Work Order No.: 03347-143-001-3335-01
U.S. EPA Contract No.: 68-C4-0022

DOCUMENT CONTROL NUMBER 4400-48-AICF

TABLE OF CONTENTS

LIST OF TABLES	iv
LIST OF FIGURES	v
1.0 INTRODUCTION	1
1.1 Objective	1
1.2 Site Background and Description	1
1.3 Project Scope	1
1.3.1 Toxicity of Coal Tar in Sediments	2
1.3.2 Accumulation of Contaminants by Earthworms	2
2.0 ASSUMPTIONS	2
3.0 METHODS	4
3.1 Field Investigation and Analysis	4
3.1.1 Sediment Sampling, Preparation, and Analysis	4
3.1.2 Soil Sampling and Analysis	4
3.2 Laboratory Investigations	5
3.2.1 Sediment Toxicity Evaluations	5
3.2.2 Earthworm Toxicity and Bioaccumulation Evaluation	5
3.3 Sampling Equipment Decontamination	5
3.4 Standard Operating Procedures	5
3.4.1 Sample Documentation	5
3.4.2 Sample Packaging and Shipment	6
3.4.3 Sampling Techniques	6
3.5 Waste Disposal	6
4.0 RESULTS AND DISCUSSION	6
4.1 General Information and Case Narrative	6
4.2 Results and Discussion of the Chemical Analysis of Sediment	7
4.2.1 VOAs in Sediment	7
4.2.2 BNAs in Sediment	7
4.2.3 Metals in Sediment	8
4.2.4 Pesticides/PCBs in Sediment	8
4.2.5 Oil and Grease in Sediment	8
4.2.6 TOC in Sediment	9
4.2.7 Grain Size of Sediment	9

4.3	Results and Discussion of the Chemical Analysis of Soil	9
4.3.1	VOAs in Soil	9
4.3.2	BNAs in Soil	9
4.3.3	Metals in Soil	9
4.3.4	Pesticides/PCBs in Soil	10
4.3.5	Oil and Grease in Soil	10
4.3.6	TOC in Soil	10
4.3.7	Grain Size of Soil	10
4.4	Results and Discussion of the Sediment Toxicity Tests	11
4.4.1	<i>Hyalella azteca</i> 14-day Survival and Growth Test	11
4.4.2	<i>Chironomus tentans</i> 14-day Survival and Growth Test	11
4.5	Results and Discussion of the Soil (Earthworm) Toxicity Test	11
4.6	Results and Discussion of the Chemical Analysis of Earthworms	11
4.6.1	Percent Lipids in Earthworms	11
4.6.2	Metals in Earthworms	11
4.6.3	Pesticides/PCBs in Earthworms	12
5.0	RISK CHARACTERIZATION	12
5.1	Risk of Coal Tar to Benthic Invertebrates	12
5.2	Risk Characterization of Soil Contaminants to Worm-Eating Receptors	13
5.2.1	Contaminants Evaluated	13
5.2.2	Food Chain Model and Hazard Quotient Method	14
5.2.3	Results and Conclusions of the Risk Characterization for Worm-Eating Birds	15
5.2.4	Results and Conclusions of the Risk Characterization for Worm-Eating Mammals ...	16
6.0	UNCERTAINTY ANALYSIS	17
6.1	General Overview of Uncertainty Analysis	17
6.2	Site-Specific Uncertainty Analysis	18
7.0	CONCLUSIONS	20
8.0	LITERATURE CITED	22

APPENDICES

- A Final Report for the *Hyalella azteca* and *Chironomus tentans* Sediment Toxicity Tests
- B Final Report for the Earthworm Toxicity Test
- C Final Analytical Reports
- D Hazard Characterization and Toxicity Profiles
- E Life Histories and Exposure Profiles

LIST OF TABLES

Number	Title
1	Results of the VOAs Analysis in Sediment (Dry Weight)
2	Results of the the BNAs Analysis in Sediment (Dry Weight)
3	Results of the TAL Metals Analysis in Sediment (Dry Weight)
4	Results of the Pesticides/PCBs Analysis in Sediment (Dry Weight)
5	Results of the Oil and Grease Analysis in Sediment
6	Results of the TOC Analysis in Sediment
7	Results of the Grain Size Analysis of Sediment
8	Results of the VOAs Analysis in Soil (Dry Weight)
9	Results of the BNAs Analysis in Soil (Dry Weight)
10.1	Results of the TAL Metals Analysis in Soil (Dry Weight)
10.2	Results of the TAL Metals Analysis in Soil (Wet Weight)
11.1	Results of the Pesticides/PCBs Analysis in Soil (Dry Weight)
11.2	Results of the Pesticides/PCBs Analysis in Soil (Wet Weight)
12	Results of the Oil and Grease Analysis in Soil
13	Results of the TOC Analysis in Soil
14	Results of the Grain Size Analysis of Soil
15	Results of the <i>Hyalella azteca</i> Sediment Toxicity Test
16	Results of the <i>Chironomus tentans</i> Sediment Toxicity Test
17	Results of the Earthworm Toxicity Test
18	Results of the TAL Metals Analysis in Earthworms (Wet Weight)
19	Results of the Pesticides/PCBs Analysis in Earthworms (Wet Weight)
20	Hazard Quotient Calculations for Worm-Eating Birds (American Robin)
21	Hazard Quotient Calculations for Worm-Eating Mammals (Short-tailed shrew)

LIST OF FIGURES

Number	Title
1	Sample Locations

1.0 INTRODUCTION

1.1 Objective

The objective of this project was to provide technical support to the United States Environmental Protection Agency in collecting and interpreting data to supplement the ecological risk assessment for the Chattanooga Creek/Tennessee Products site, Chattanooga, Tennessee.

1.2 Site Background and Description

The Tennessee Products (Chattanooga Creek) site is located in Chattanooga, Hamilton County, Tennessee. Chattanooga Creek flows for 26 miles through the site, flowing from the Tennessee/Georgia state line northward to the Tennessee River. Of the 75 square miles of drainage area for the creek, 20 percent is located in an urban/industrial part of the Chattanooga Valley.

Prior to the 1970s, Chattanooga Creek was contaminated by coal tar residues discharged by surrounding industries. The Chattanooga Coke and Chemical Company (formerly Tennessee Products Company) had been a major contributor of industrial waste and is believed to have been a primary source of the coal tar contamination. Coal tar contains toxic chemicals such as polycyclic aromatic hydrocarbons (PAHs), benzene, cyanide, and mercury. Although pollution abatement measures brought industrial discharges under control, contamination still pervaded the creek as well as the surrounding soils and sediment.

Numerous ecological studies have been conducted at the Tennessee Products (Chattanooga Creek) site during the past 20 years. In 1980 and 1990, two studies revealed that water quality and sediment characteristics at the northern (downstream) end of the creek had not significantly improved since initial ecological studies had been completed in 1970. A 1992 sediment profile study by the U.S. Environmental Protection Agency revealed the presence of coal tar residues extending downstream of the Coke and Chemical Plant for more than two miles. Another field investigation was performed by Roy F. Weston, Inc. in the fall of 1994 and spring of 1995, and the results of the investigation were used to conduct an ecological risk assessment for the U.S. EPA (Roy F. Weston 1996). The risk assessment was conducted according to the guidelines established in the Ecological Risk Assessment Guidance for Superfund (U.S. EPA 1997).

After the initial ecological risk evaluation was conducted, the U.S. EPA remediated some of the areas in and around the creek. For example, the area around the original Tar Deposit Site (Figure 1) and some sections of the creek upstream of Dump Number 2 (Figure 1) have been remediated. In addition, the creek has been remediated between Hamill Road and 1,400 feet north of 38th street.

1.3 Project Scope

The U.S. EPA identified two areas in which the conclusions of the initial ecological risk evaluation should be refined with site-specific data. Therefore, the scope of this project was to provide additional data to reevaluate these conclusions. The information and findings will be used to supplement the baseline risk assessment. The two conclusions are discussed next.

1.3.1 Toxicity of Coal Tar in Sediments

The first conclusion in the initial risk assessment to be refined relates to the assessment endpoint "Survival, growth, and reproduction of aquatic life in Chattanooga Creek." Specifically, in the original risk assessment, the coal tar deposits in Chattanooga Creek were not directly linked to sediment toxicity. To address this, sediment toxicity tests were performed using samples of coal tar and sediment collected from the creek. In addition, the sediment samples were submitted for chemical analysis.

1.3.2 Accumulation of Contaminants by Earthworms

The second conclusion in the initial risk assessment to be refined relates to the assessment endpoint "Survival, growth, and reproduction of mammals and birds that feed in Chattanooga Creek, or in the vicinity of the Tar Dump and Hamill Road Dump Number 3." In the original risk assessment, the degree to which site contaminants had accumulated in earthworms inhabiting site soil was unknown. Earthworm concentrations that were entered into the exposure models for worm-eating mammals and birds were based on estimated concentrations calculated from bioaccumulation factors found in the literature rather than actual measured concentrations. The results indicated that aluminum, chromium, lead, manganese, mercury, nickel, vanadium, zinc, DDT, dieldrin, endrin, α -BHC, γ -BHC and heptachlor present a potential risk to worm-eating receptors at the site. To refine these conclusions, a 28-day earthworm bioaccumulation study using site soil samples was used to better predict the earthworm contaminant concentrations at the site. The concentrations were then entered into the exposure models for worm-eating mammals and birds to obtain a more realistic scenario.

2.0 ASSUMPTIONS

The following conservative assumptions were made to conduct this study:

- ◆ Mean and maximum contaminant levels measured in soil and tissue were used in the risk calculations and assumed to be present site-wide.
- ◆ As discussed in Section 5.2.2, for the purposes of the food chain models if a contaminant was not detected in either a soil or an earthworm sample, it was assumed to actually be present in the sample at one-tenth the detection limit for organics or one-half the detection limit for inorganics.
- ◆ Contaminants in food items were assumed to be 100 percent bioavailable and not metabolized and/or excreted during the life of the receptor. However, most toxicity reference values (TRVs) are based on administered doses in toxicity tests rather than the resulting absorbed doses. Therefore, this assumption probably does not greatly influence the results of the analysis.
- ◆ Dietary composition information was obtained from the literature for the receptor species evaluated using the food chain model. However, simplifications of complex diets were assumed for the receptors. Since earthworms were the only food items that were analyzed for contaminants in this study, the receptors evaluated using the food chain model were assumed to consume 100 percent earthworms.
- ◆ For calculations of area use factors for the American robin and the short-tailed shrew, the minimum reported home ranges were assumed.

- ◆ Since most benchmark values were derived using dosing intervals shorter than seasonal life history events, it was deemed appropriate to not consider seasonal factors in the life histories of avian receptors for the purposes of this risk assessment. Therefore, breeding territories rather than full migratory ranges were used to calculate the area use factor for the American robin. To calculate the area use factor, the robin's estimated breeding territory was divided by the estimated area of the site. However, the resulting area use factor, in reality, is only applicable during the breeding season. The portion of the year that the robin has migrated elsewhere and is therefore not utilizing the site was not accounted for in the area use factor for the American robin. Therefore, it was assumed that the robin was present year-round.
- ◆ A literature search was conducted to determine the chronic toxicity of the contaminants of concern evaluated in the food chain model. If no toxicity values could be located for the receptor species, values reported for a closely related species were used. Studies were critically reviewed to determine whether study design and methods were appropriate. If values for chronic toxicity were not available, LD₅₀ (median lethal dose) values were used. For the purposes of this study, a factor of 100 was used to convert the reported LD₅₀ to a No Observable Adverse Effect Level (NOAEL). A factor of 10 was used to convert a reported Lowest Observable Adverse Effect Level (LOAEL) to a NOAEL. If several toxicity values were reported for a receptor species, the most conservative value was used in the risk calculations as long as the study design, exposure route, mechanism, and species tested were deemed appropriate. For the chronic toxicity endpoints, values obtained from long-term feeding studies were used in preference to those obtained from single dose oral studies. No other safety factors were incorporated into this study.
- ◆ To determine the dietary toxicity of aluminum to mammals, toxicity information from studies in which aluminum was orally administered via drinking water was used. Therefore, it was assumed that exposure to aluminum in drinking water would be similar to exposure to aluminum in food items.
- ◆ Soil ingestion rates for the American robin and the short-tailed shrew could not be found in the literature. Therefore, estimated soil ingestion rates were based on those reported in the literature for the American woodcock. It was assumed that the ingestion rate of the American woodcock, as a percentage of dietary intake, is representative of the soil ingestion rates for the American robin and the short-tailed shrew.
- ◆ In some cases, toxicity values in the literature were reported as milligrams of contaminant per kilogram (mg/kg) in the diet. These were converted to daily intake (in milligrams per kilogram body weight per day; [mg/kg BW/day]) by using the following formula:

$$\text{Daily Intake (mg/kg BW/day)} = \text{Contaminant Dose (mg/kg diet)} \times \text{Ingestion Rate (kg/day)} \times 1/\text{Bodyweight (kg)}$$

This conversion allowed dietary toxicity levels cited to be converted to a daily dose based on body weight.
- ◆ In the food chain model, the lowest reported body weights and the highest reported ingestion rates for adults were assumed in each case.
- ◆ Some of the toxicity values (NOAELs and LOAELs) were derived from data for which dosages were only reported as dry weight, and the authors did not give enough information to convert them to wet weight. Therefore, it was assumed that the food administered in these studies consisted of one-third solids to convert the dosages to wet weight.

3.0 METHODS

3.1 Field Investigation and Analysis

A field investigation was conducted to collect the information necessary to address the data gaps described previously for use in the ecological risk assessment. This investigation involved the collection and chemical analysis of soil and sediment. A description of each task follows.

3.1.1 Sediment Sampling, Preparation, and Analysis

Sediment samples were collected in accordance with ERTC/ Response Engineering and Analytical Contract (REAC) Standard Operating Procedure (SOP) #2016, *Sediment Sampling*. Sediment samples were collected using a decontaminated Ponar dredge or stainless steel augers and deposited into labeled 5-gallon plastic buckets until the volume was sufficient to meet analytical and toxicity testing volume requirements. Five sediment samples were collected in total. One of these samples was collected from the reference area (REF), one was taken from a coal tar deposit in the creek (CTR), one was collected directly above the coal tar deposit (ACTR), and two were collected from locations where remedial activities have occurred (REM-1 and REM-2). The sampling locations are indicated in Figure 1. Once collected, the bulk samples were covered and returned to the staging area. The samples were then shipped to REAC on wet ice.

Upon receipt at REAC, five dilutions of coal tar and reference sediment were prepared to obtain a concentration gradient of coal tar. The resulting dilution ratios of coal tar:reference sediment were 6 percent, 12 percent, 25 percent, and 50 percent. These mixtures, along with a reference sediment sample, the two samples collected from the remediated areas (REM-1 and REM-2), and the sample collected above the coal tar deposit (ACTR) were submitted for analysis of Target Analyte List (TAL) metals, pesticides, polychlorinated biphenyls (PCBs), base-, neutral-, and acid extractables (BNAs), volatile organic aromatics (VOAs), total organic carbon (TOC), grain size, and oil and grease. They were also submitted for use in two solid-phase sediment toxicity tests, as described in Section 3.2.1. It should be noted that the coal tar sample itself (CTR) was only used to provide the material for the various mixtures and therefore was not submitted for analysis.

3.1.2 Soil Sampling and Analysis

Soil samples were collected in accordance with ERTC/REAC SOP #2012, *Soil Sampling*. Five soil samples (S-1, S-2, S-3, S-4, and S-5) were collected from the vicinity of Dump Number 3 (Figure 1) and one soil sample (S-TA) was collected from the vicinity of the old Coal Tar Dump, which has been remediated. In addition, one soil sample (REF) was collected from the designated reference area. The exact locations are illustrated in Figure 1. Soil was collected using a decontaminated stainless steel trowel to a depth of six inches. The soil within a 1.5-foot by 1.5-foot area was collected and accumulated in a labeled 5-gallon plastic bucket until sufficient sample volume was obtained for all required testing and chemical analyses. The samples were then transported to the staging area, where they were labeled and shipped to REAC on wet ice. Upon receipt at REAC, the samples were homogenized, aliquoted into appropriate containers, and submitted for analyses. The soil samples were analyzed for TAL metals, pesticides/PCBs, BNAs, VOCs, total organic carbon, grain size, and oil and grease. The soil samples were also used for a 28-day earthworm toxicity and bioaccumulation assay, as described in Section 3.2.2.

3.2 Laboratory Investigations

3.2.1 Sediment Toxicity Evaluations

After the sediment samples were prepared, as described in Section 3.1.1, they were shipped to American Aquatic Testing, Inc. in Allentown, Pennsylvania for toxicity testing. The tests included two solid-phase whole sediment toxicity tests, a 10-day toxicity test using 7 to 14-day old amphipods (*Hyalella azteca*), and a 10-day toxicity test using juvenile chironomids (*Chironomus tentans*). Testing procedures followed those outlined by the U.S. EPA Office of Research and Development (U.S. EPA 1994) and are explained in detail in Appendix A.

3.2.2 Earthworm Toxicity and Bioaccumulation Evaluation

After the samples were prepared, as described in Section 3.1.2, they were shipped to the U.S. EPA Region 4 Science and Ecosystem Support Division Laboratory in Athens, Georgia for bioaccumulation and toxicity testing using the earthworm (*Eisenia foetida*). This species is commonly used for soil toxicity evaluations, and an extensive literature base exists for comparison with the results. The primary purpose of this evaluation was to obtain data on the bioaccumulation of site contaminants in earthworms to enter into the food chain models for worm-eating birds and mammals. A toxicity test was also conducted in conjunction with the bioaccumulation assay since the toxicity test merely required an additional observation period for mortality and weight at 14 days (the midpoint of the study). The test was then continued for an additional 14 days, after which survival was again noted, and worms were weighed and submitted for chemical analysis. The results of the toxicity test portion of the assay were used as a simple comparison with the results of the earthworm toxicity test performed for the original risk assessment. The toxicity and bioaccumulation assay was conducted using soil from six on-site locations as well as the reference area. Testing procedures followed those outlined by the U.S. EPA Environmental Research Laboratory in Corvallis (U.S. EPA 1989) and are also explained in Appendix B.

3.3 Sampling Equipment Decontamination

The following sampling equipment decontamination procedure was employed prior and subsequent to sampling each location in the following numerical sequence:

- 1 physical removal
- 2 nonphosphate detergent wash (Liquinox)
- 3 potable water rinse
- 4 distilled/deionized water rinse
- 5 10 percent nitric acid rinse
- 6 solvent rinse (Acetone)
- 7 distilled water rinse
- 8 air dry

3.4 Standard Operating Procedures

3.4.1 Sample Documentation

Sample documentation was completed per the following Environmental Response Team (ERTC)/Response Engineering and Analytical Contract (REAC) Standard Operating Procedures (SOPs):

- ERTC/REAC SOP #2002, *Sample Documentation*
- ERTC/REAC SOP #4005, *Chain of Custody Procedures*

3.4.2 Sample Packaging and Shipment

Sample packaging and shipment were conducted in accordance with the following ERTC/REAC SOP:

- ERTC/REAC SOP #2004, *Sample Packaging and Shipment*

3.4.3 Sampling Techniques

Field activities were conducted in accordance with the following ERTC/REAC SOPs:

- ERTC/REAC SOP #2012, *Soil Sampling*
- ERTC/REAC SOP #2016, *Sediment Sampling*
- ERTC/REAC SOP #2055, *Ten-day Renewal Test for Determining Acute Toxicity of Sediments to the Freshwater Amphipod, *Hyalella azteca* and the Midge *Chironomus tentans**

3.5 Waste Disposal

All the treated and untreated samples will be maintained for 60 days after the issuance of the final report. If no additional testing has been requested at the end of 60 days, with the approval and concurrence of the Task Leader, arrangements will be made for sample disposal.

4.0 RESULTS AND DISCUSSION

4.1 General Information and Case Narrative

The analytical data and toxicity test results are summarized in Tables 1 to 19. Full analytical results are also presented in Appendix C, and toxicological evaluation reports are presented in Appendices A and B. A brief summary of the analytical and toxicological results is presented in Section 4.2.

All analytical results for organics in sediment and soil are reported in units of micrograms per kilogram (ug/kg). All results for metals in soil and sediment are reported in milligrams per kilogram (mg/kg). All oil and grease results for soil and sediment are reported in units of milligrams per kilogram (mg/kg), and all TOC and grain size results are reported as percentages. All analytical results for earthworm tissue are reported as milligrams of contaminant per kilogram of tissue (mg/kg).

The analytical results generated from the analysis of sediment and soil are reported by the laboratories on a dry weight (dw) basis. The percent solids determination for each sample is also included. Since the food chain model/hazard quotient method in this study compares estimated dosages of contaminants to effects levels from the literature that are reported on a wet weight basis, the analytical results for metals and pesticides/PCBs in soil were converted to a wet weight basis to maintain consistency with the literature effects levels. This was done by multiplying the dry weight concentrations by the percent solids values. The wet weight concentrations, along with the dry weight concentrations, are presented in their respective tables for these parameters.

The analytical results generated from the analysis of earthworm tissue are reported by the laboratory on a wet weight (ww) basis. Since the concentrations of contaminants in earthworm tissue were only used for the food chain models, and since the food chain models required that wet weight concentrations be used, as described previously, there was no need to convert these concentrations to dry weight concentrations. Therefore, the concentrations of metals and pesticides/PCBs in earthworm tissue are presented in the tables on a wet weight basis only.

4.2 Results and Discussion of the Chemical Analysis of Sediment

4.2.1 VOAs in Sediment

The results of the analysis of VOAs in sediment are presented in Table 1. In summary, no VOAs were detected in the reference sample or in the 6 percent mixture of coal tar. In the remaining samples, acetone, chlorobenzene, ethyl benzene, m- and/or p-xylene, o-xylene, o-chlorotoluene, p-chlorotoluene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichlorobenzene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, 1,2,4-trichlorobenzene, 1,2,3-trichlorobenzene, and indane were the only VOAs that were detected in any of the sediment samples. Most of these contaminant concentrations were estimated because they were detected below the detection limit. Exceptions to this included sample REM-2 and the 25 percent and 50 percent mixtures of coal tar. In sample REM-2, chlorobenzene, 1,4-dichlorobenzene, and 1,2,4-trimethyl benzene were detected above the detection limit. In the 25 percent and 50 percent mixtures, chlorobenzene, o-chlorotoluene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, and 1,2-dichlorobenzene were detected above the detection limit.

As expected, a concentration gradient is observable, with increasing concentrations of VOAs as the ratio of coal tar:reference sediment increases in the sediment mixtures. In addition, it is evident that the remediated sample collected farther downstream (REM-2) was more contaminated by VOAs than the other remediated sample that was collected farther upstream (REM-1).

4.2.2 BNAs in Sediment

The results of the analysis for BNAs in sediment are presented in Table 2. In summary, twelve BNAs were detected in the reference sediment, although most of these concentrations were estimated because they were detected below the detection limit. Two exceptions were fluoranthene and pyrene, which were detected at concentrations of 1600 and 1000 ug/kg, respectively. In the remaining samples, a total of twenty-nine BNAs were detected. These BNAs were present in the remaining samples at concentrations greater than their concentrations in the reference sediment with two exceptions: benzo(k)fluoranthene and carbazole. In most cases, if a BNA was detected in one sample, it was also detected in the remaining samples. One exception to this was the remediated sample collected farther downstream (REM-2), in which nine BNAs were detected only in this sample. The BNAs that were detected in the samples and the concentrations at which they were detected are listed in Table 2.

In general, the lowest concentrations of BNAs were detected in either the remediated sample collected farther upstream (REM-1) or in the 6 percent coal tar mixture. In each case, the BNA concentrations in the remediated sample collected farther downstream (REM-2) were higher than in the remediated sample collected farther upstream (REM-1), thus mimicking the results of the VOA analysis. In addition, a concentration gradient is again evident, with

increasing concentrations of BNAs as the ratio of coal tar:reference sediment increases in the sediment mixtures.

4.2.3 Metals in Sediment

The results of the analysis for TAL metals in sediment are presented in Table 3. In summary, every TAL metal was detected in at least one sediment sample with the exceptions of molybdenum, silver, sodium, and tellurium, which were not detected in any samples. Of the metals that were detected, only three (antimony, thallium, and tin) were not detected in the reference sample. All of the remaining detected metals were detected in the reference sample at concentrations that were within the range of concentrations detected in the other samples. Similar to the VOAs and BNAs, but to a lesser degree, metals were detected at higher concentrations in the remediated sample collected farther downstream (REM-2) than in the remediated sample collected farther upstream (REM-1). Sixteen of the detected metals were present at greater concentrations in the REM-2 sample than the REM-1 sample, as opposed to seven metals that were detected at greater concentrations in the REM-1 sample. The trend that the concentrations of contaminants increases with an increasing ratio of coal tar:reference sediment in the mixtures is also followed by the metals data, although again not to as great an extent as the VOA and BNA data.

4.2.4 Pesticides/PCBs in Sediment

The results of the analysis for pesticides and PCBs in sediment are presented in Table 4. No PCBs were detected in any of the sediment samples. Three pesticides were detected in the reference sediment sample: a-BHC, dieldrin, and p,p'-DDD. However, the concentrations of both a-BHC and p,p'-DDD were estimated concentrations because they were detected below the detection limit. Nevertheless, the reference sediment was the only sediment sample in which p,p'-DDD was detected, and the concentration of dieldrin in the reference sediment sample was greater than the concentrations detected in any of the other samples.

In the remaining samples, a total of six pesticides were detected, including a-BHC, b-BHC, d-BHC, dieldrin, endrin, and methoxychlor. Of these, the only pesticides that were relatively consistently present in all or most of the samples were the three BHC isomers. All of these isomers followed the trend of increasing concentrations with increasing ratios of coal tar:reference sediment in the mixtures. In addition, each of the BHC isomers was present in the remediated sample collected farther downstream (REM-2) at higher concentrations than in the remediated sample collected farther upstream (REM-1). No trends were identified for the remaining pesticides that were detected.

4.2.5 Oil and Grease in Sediment

The results of the oil and grease analysis in sediment are presented in Table 5. In summary, oil and grease concentrations ranged from a low of 351 mg/kg (dry weight) in the reference sediment to a high of 1080 mg/kg (dry weight) in the 50 percent coal tar mixture. The concentrations of oil and grease in the reference sediment were less than the concentrations in all other sediment samples except for the remediated sample collected farther upstream (REM-1) and the 25 percent coal tar mixture. The trend of increasing concentrations with an increasing ratio of coal tar:reference sediment in the mixtures was observed, with the exception of the 25 percent mixture, which appears to be an anomaly. In addition, the concentrations of oil and grease were greater in the REM-2 (farther downstream) remediated sample than in the REM-1 (farther upstream) remediated sample.

4.2.6 TOC in Sediment

The results of the TOC analysis in sediment are presented in Table 6. In summary, the TOC content of the sediment samples ranged from a low of 4.52 percent TOC in the REM-2 sample to 14 percent TOC in the 6 percent mixture. No trends were observed, with the exception that the TOC concentrations of the two remediated samples were less than the remaining samples.

4.2.7 Grain Size of Sediment

The results of the grain size analysis of sediment are presented in Table 7. No trends were observed except that all samples consisted primarily of sand.

4.3 Results and Discussion of the Chemical Analysis of Soil

4.3.1 VOAs in Soil

The results of the VOAs analysis in soil are presented in Table 8. Only one VOA, acetone, was detected. This contaminant was detected in samples S-5 and S-TA. Since acetone is a common field and laboratory contaminant, no conclusions can be made about the presence of this substance in soil at the site.

4.3.2 BNAs in Soil

The results of the BNA analysis in soil are presented in Table 9. In summary, ten BNAs were detected in the reference soil, although the concentrations of each of these BNAs were estimated because they were detected below the detection limit. Nonetheless, the concentrations of each BNA detected in the reference soil were less than the concentrations of those BNAs in all other soil samples. A total of fourteen BNAs were detected in the remaining soil samples. A general trend was observed in that the highest BNA concentrations were detected in sample S-2. The next highest concentrations were found in either sample S-3 or S-TA. This was followed in decreasing order by sample S-1, S-5, and S-4. When a linear regression analysis was performed to determine whether a correlation exists between BNA concentrations in soil and soil physical properties such as grain size and TOC, the results indicated a lack of correlation, with r-squared values ranging from 0.01 to 0.52.

4.3.3 Metals in Soil

The results of the metals analysis in soil are presented in Tables 10.1 (dry weight) and 10.2 (wet weight). In summary, every TAL metal was detected in at least one soil sample with the exceptions of molybdenum, silver, sodium, and tellurium, which were not detected in any samples. The metals that were detected in soil included aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, strontium, thallium, titanium, vanadium, yttrium, and zinc. Eight of these metals had concentrations in the reference sample that were within the ranges detected in the on-site samples. These eight metals were arsenic, beryllium, calcium, cobalt, lead, manganese, selenium, and strontium. The metals concentrations at locations S-1 through S-5 were similar, but most of the concentrations at location S-TA, where remedial activities have taken place, were slightly lower than the concentrations at the other locations. When a linear regression analysis was performed to

determine whether a correlation exists between metals concentrations and grain size (% clay), the results indicated a moderate correlation for antimony, arsenic, copper, iron, mercury, and yttrium, with r-squared values ranging from 0.59 to 0.75. A high correlation was observed for selenium, with an r-squared value of 0.9. Therefore, the clay content of the soil may help explain, in part, the trends observed in the concentrations of these metals in soil.

4.3.4 Pesticides/PCBs in Soil

The results of the analysis for pesticides and PCBs in soil are presented in Tables 11.1 (dry weight) and 11.2 (wet weight). No PCBs were detected in any of the soil samples. Three pesticides (a-BHC, dieldrin, and methoxychlor) were detected in the reference soil sample, but their concentrations were considered to be estimated because they were detected below the detection limit. One of these three pesticides, methoxychlor, was not detected in any of the on-site soil samples. In the on-site samples, a total of six pesticides were detected, including a-BHC, b-BHC, g-BHC, d-BHC, dieldrin, and p,p'-DDD. No trends were observed except that location S-TA generally had the highest concentrations of pesticides out of all the sample locations. This mirrors the results of the BNA analysis but conflicts with the results of the analysis for metals. When a linear regression analysis was performed to determine whether a correlation exists between pesticide concentrations in soil and soil physical properties such as grain size and TOC, the results indicated a lack of correlation, with r-squared values ranging from 0.01 to 0.42.

4.3.5 Oil and Grease in Soil

The results of the oil and grease analysis in soil are presented in Table 12. Oil and grease were detected in every soil sample except that from location S-4. The soil samples from locations S-1 and S-TA were relatively low compared to the other locations. Of particular note is the fact that the reference area contained the highest concentration of oil and grease, indicating that the presence of oil and grease in soil may not be a good marker of site contamination. When a linear regression analysis was performed to determine whether a correlation exists between oil and grease concentrations in soil and soil physical properties such as grain size and TOC, the results indicated a lack of correlation with grain size, with an r-squared value of 0.002. A moderate correlation was observed, however, with TOC, with an r-squared value of 0.62. Therefore, the TOC content of the soil may help explain, in part, why the oil and grease concentrations were so high at the reference area.

4.3.6 TOC in Soil

The results of the TOC analysis in soil are presented in Table 13. No specific trends were noted, except that the reference area had the highest concentration of TOC, and location S-TA, where remedial activities have occurred, had the lowest TOC concentration.

4.3.7 Grain Size of Soil

The results of the grain size analysis of soil are presented in Table 14. The reference location had roughly equal amounts of sand, silt, and clay, while the remaining samples consisted mostly of clay, followed in decreasing order by silt and sand. One exception to this was location S-4, in which silt was the primary component of the soil, followed by clay and then sand.

4.4 Results and Discussion of the Sediment Toxicity Tests

4.4.1 *Hyalella azteca* 14-day Survival and Growth Test

The results of the *Hyalella azteca* 14-day survival and growth toxicity test are summarized in Table 15. Percent survival in the reference sediment was not statistically different from percent survival in the control. Percent survival of the test organisms in each of the test sediments was significantly lower than percent survival in both the reference and control sediment. Due to the low survival of the test organisms in the test sediments, an evaluation of the growth endpoint is not appropriate.

4.4.2 *Chironomus tentans* 14-day Survival and Growth Test

The results of the *Chironomus tentans* 14-day survival and growth toxicity test are summarized in Table 16. Percent survival in the reference sediment was not statistically different from percent survival in the control. Percent survival of the test organisms in each of the test sediments except for the 6 percent mixture and the remedial sample collected farther upstream (REM-1) was significantly lower than percent survival in both the reference and control sediments. Mean growth of the test organisms was also significantly lower in the 25 percent and 50 percent mixtures than in the reference and the control sediments, and growth was not statistically different between the reference sediment and the control.

4.5 Results and Discussion of the Soil (Earthworm) Toxicity Test

The results of the earthworm toxicity test are presented in Table 17. In summary, no significant differences were observed in either survival or growth of earthworms in any of the test soils compared to either the reference or control soils. These results support the results of the earthworm toxicity test performed previously for the original ecological risk assessment using soil samples collected from the same vicinity as the samples collected for the current study. In the previous earthworm toxicity test, no significant toxic effects were observed in any of the soil samples tested (Weston 1996).

4.6 Results and Discussion of the Chemical Analysis of Earthworms

4.6.1 Percent Lipids in Earthworms

The results of the percent lipids analysis of earthworms at the end of the earthworm toxicity test, described previously, are presented in Tables 18 and 19. The percent lipids ranged from a low of 1.4 percent in one replicate for location A-1 to a maximum of 10.3 percent in one replicate from location S-TA, where remediation activities have occurred.

4.6.2 Metals in Earthworms

The results of the analysis for metals in earthworm tissue are presented in Table 18. No trends were observed in the data. The metals that were detected in at least one of the earthworm samples included aluminum, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, nickel, potassium, selenium, sodium, strontium, titanium, vanadium, and zinc. Of particular note is the fact that the metals concentrations in earthworms exposed to soil collected at location S-TA, where remedial activities have occurred, are similar to the concentrations detected in the earthworms exposed to soil collected at locations S-1 through S-5.

4.6.3 Pesticides/PCBs in Earthworms

The results of the analysis for pesticides and PCBs in earthworm tissue are presented in Table 19. No PCBs were detected in any earthworm samples. Four pesticides were detected in at least one of the earthworm samples. Heptachlor, dieldrin, and endosulfan II were detected in one of the replicates for location S-2. Dieldrin was also detected in one of the replicates from location S-3, and toxaphene was detected in one of the replicates for location S-4. Each of these were detected right at or around its detection limit, which explains why these pesticides were detected in some replicates and not others from the same test treatment. No other pesticides were detected in any of the remaining samples, including the reference sample.

5.0 RISK CHARACTERIZATION

5.1 Risk of Coal Tar to Benthic Invertebrates

The results of the *Hyalella azteca* and *Chironomus tentans* sediment toxicity tests indicate that coal tar is toxic to benthic invertebrates. A dose-response was observed in both assays, in which the percent survival of the test organisms decreased as the percentage of coal tar in the sediment mixtures increased. For example, for the *Chironomus tentans* assay, the mixture containing the least amount of coal tar (6 percent) was the only coal tar mixture that did not result in significant mortality compared to both the reference sediment and the laboratory control. The percent survival in the reference sediment was 81.3 percent and decreased with increasing percentages of coal tar as follows: 6 percent coal tar resulted in 77.5 percent survival, 12 percent coal tar resulted in 61.3 percent survival, 25 percent coal tar resulted in 7.5 percent survival, and 50 percent coal tar resulted in 5 percent survival. The decrease in growth of *C. tentans* was also dose-related, although to a lesser extent. The two mixtures containing the highest concentrations of coal tar (25 percent and 50 percent) were the only two coal tar mixtures that resulted in a significant decrease in growth compared to the reference and the control.

In the *Hyalella azteca* toxicity test, all the coal tar mixtures resulted in significant mortality of the test organisms, indicating that *H. azteca* is probably more sensitive to coal tar than *C. tentans*. Again, a clear dose-response relationship was observed. The percent survival in the reference sediment was 85 percent and decreased with increasing percentages of coal tar as follows: 6 percent coal tar resulted in 46.3 percent survival, 12 percent coal tar resulted in 10 percent survival, and the 25 percent and 50 percent mixtures of coal tar resulted in 0 percent survival. No differences in growth were observed between any of the coal tar mixtures, although the growth results were biased since there were no survivors in the 25 percent and 50 percent mixtures.

The observance of a distinct dose-response relationship in both the *C. tentans* and the *H. azteca* toxicity tests clearly demonstrates that coal tar causes direct toxicity to benthic invertebrates. However, to make a determination about the risk of coal tar to benthic invertebrates, it must also be demonstrated that benthic invertebrates are exposed to coal tar in the field. A demonstration of such exposure can sometimes be difficult, especially if the contaminants in question are non-bioaccumulative, as many VOAs and BNAs are. However, in the original risk assessment, exposure of some coal tar contaminants was exhibited by the fact that three PAHs and 20 metals were detected in clam tissue collected from the site. The three PAHs (benzo[a]anthracene, chrysene, and fluranthene) and one of the metals (mercury) are common constituents of coal tar. Although mercury was also detected at a similar concentration in reference clams in the original risk assessment, PAHs were not detected in the reference clams. The presence of these PAHs in clam tissue collected from

the site indicates the probability that benthic invertebrates are being exposed to coal tar in Chattanooga Creek.

Since both toxicity and exposure have been demonstrated with respect to the effects of coal tar on benthic invertebrates in Chattanooga Creek, the weight of evidence suggests that coal tar is indeed posing a risk to the survival and growth of benthic invertebrates in Chattanooga Creek. Therefore, the data from the current study indicates that the original assessment endpoint, "survival, growth, and reproduction of aquatic life in Chattanooga Creek" is at risk from the coal tar deposits that are currently present in the creek.

5.2 Risk Characterization of Soil Contaminants to Worm-Eating Receptors

5.2.1 Contaminants Evaluated

The risk to worm-eating birds and mammals was evaluated in the original ecological risk assessment for the Chattanooga Creek site. In that risk assessment, the exposure of worm-eating birds and mammals to site contaminants was calculated based on earthworm bioaccumulation factors that had been derived from the literature. However, a more accurate and direct method of estimating exposure in this case would have been to perform an earthworm bioaccumulation assay using site soil samples and to measure the resulting earthworm tissue concentrations of contaminants. This data gap was addressed in this study by performing a 28-day earthworm bioaccumulation assay. The resulting earthworm tissue concentrations were entered into food chain models for worm-eating birds and mammals, as described next, to calculate new hazard quotients for those contaminants that the original risk assessment found were presenting a risk to worm-eating birds and mammals. The selection of contaminants to be evaluated using the bird and mammal food chain models was based on the contaminants which, in the original risk assessment, were found to pose a risk to worm-eating birds and mammals. For example, those contaminants found to pose a risk to worm-eating birds in the original risk assessment were reevaluated using the bird food chain model in the current study using the new data. Similarly, the contaminants found to pose a risk to worm-eating mammals in the original risk assessment were reevaluated using the mammal food chain model in the current study. Therefore, the contaminants that were evaluated using the new data are listed next:

Contaminants Evaluated for Worm-Eating Birds

aluminum
chromium
lead
manganese
mercury
nickel
vanadium
zinc
DDT
dieldrin
endrin
heptachlor

Contaminants Evaluated for Worm-Eating Mammals

aluminum
lead
manganese
nickel
zinc
b-BHC
g-BHC
dieldrin

5.2.2 Food Chain Model and Hazard Quotient Method

The hazard quotient method (Barnthouse et al. 1986; U.S. EPA 1997) was employed to predict the effects of soil contamination at the Chattanooga Creek to worm-eating birds and mammals. The hazard quotient method compares exposure concentrations to ecological endpoints such as reproductive failure or reduced growth. The comparisons are expressed as ratios of potential intake values to population effect levels, as follows:

$$\text{Hazard Quotient} = \frac{\text{Exposure Concentration (Mean or Maximum)}}{\text{Effect Level (NOAEL or LOAEL)}}$$

The effect level values are based on studies published in the literature, which are summarized in Appendix D. The effects levels developed for this study may differ from those used in the original ecological risk assessment for a variety of reasons. First, in the original risk assessment, a safety factor of 5 was used to convert an LD50 to a NOAEL and to convert a LOAEL to a NOAEL. In addition, if an effects level was derived from a study in which the test species was within the same class, but was a different species from the receptor species in question, a safety factor of 5 was also used. In the current study, a conversion factor of 10 was used only to convert an acute effects level to a LOAEL, or to convert a LOAEL to a NOAEL, if necessary. Due to the differences in application of safety factors, the effects levels in this study may differ from the effects levels in the original risk assessment. Furthermore, for this study, a complete review of the literature was conducted to derive the most appropriate effects level. In some cases, studies were found that were determined to be more appropriate than the one used to derive the effects level in the original risk assessment. This is another factor that contributed to the effects levels differing between the original risk assessment and this study.

The exposure concentrations were estimated by employing a food chain model for each receptor species (Tables 20 and 21). In these food chain models, ingestion rates of each contaminant of concern for each receptor species are determined based on known or estimated soil and food ingestion rates and body weights of each receptor species (Appendix E), as well as the measured concentrations of each contaminant in soil collected from the site and earthworms from the bioaccumulation assay. The ingestion rates and body weights used for this study may differ from those used in the original risk assessment because in some cases, ingestion rates were found in the literature that were deemed to be more appropriate than those used in the original risk assessment.

The exposure concentrations and toxicity values calculated from the food chain model are entered into the hazard quotient equation, and a hazard quotient is calculated. If the hazard quotient is greater than one based on a NOAEL, this indicates that there is a potential chronic risk from that contaminant to the ecological receptor in question. If the hazard quotient is greater than one based on a LOAEL for a particular contaminant, this indicates a more serious risk in that the site levels of that contaminant have the potential to produce an actual adverse effect on survival, reproduction, or growth of the ecological receptor in question. The hazard quotient should be interpreted based on the severity of the effect reported.

For the purposes of the food chain model, if a contaminant was not detected in a soil or earthworm sample, the contaminant was assumed to actually be present in the sample at one-tenth the detection limit for organics or one-half the detection limit for inorganics. This is based on the fact that even though a contaminant was not detected in a sample, it may still be present in the sample at a very low concentration. Using the analytical method employed

for inorganics in this study, a detection below the detection limit is not reliable due to the analytical variability produced by the instrumentation within this range. Therefore, a number is only reported for inorganics if the analyte is detected above the detection limit. For organic contaminants, a detection below the detection limit is much more reliable and is thus reported with a data qualifier of "J" for "estimated." Therefore, for inorganics, if a contaminant was reported as non-detect, it was assumed to actually be present at one-half the detection limit as a conservative assumption for the purposes of this risk assessment. For organics, however, concentrations of one-half the detection limit would usually be detected and thus would be reported with a data qualifier of "J." Therefore, if an organic contaminant was reported as non-detect, then it was assumed that the contaminant was actually present at one-tenth the detection limit as a conservative assumption for the purposes of this risk assessment.

The maximum contaminant concentrations in earthworms and soil were initially entered into the model to calculate hazard quotients. If a hazard quotient greater than one was calculated for a particular contaminant, the mean concentration of that contaminant was calculated and entered into the model to represent a more realistic scenario. To calculate the mean contaminant concentrations, the arithmetic mean for all the soil sampling locations (S-1 through S-5 and S-TA) was calculated. All soil and earthworm tissue concentrations used in the food chain model were on a wet weight basis.

5.2.3 Results and Conclusions of the Risk Characterization for Worm-Eating Birds

The food chain model and chronic hazard quotient calculations for worm-eating birds are presented in Table 20. Using the maximum concentrations for each contaminant of concern, a hazard quotient of greater than one was calculated for aluminum using both the NOAEL and LOAEL and for lead and vanadium using only the NOAEL. When the mean contaminant concentrations were used, virtually the same outcome was achieved, but with slightly lower hazard quotients.

For aluminum, although the hazard quotients were greater than one for both the NOAEL and LOAEL using both the maximum and mean contaminant concentrations, these hazard quotients were relatively low (ranging from 1.02 for the LOAEL using the mean concentrations to 2.2 for the NOAEL using the maximum concentrations). Furthermore, the NOAELs and LOAELs were derived using a study in which the form of aluminum was aluminum sulfate (Wisser et al. 1990). The mechanism of toxicity of aluminum sulfate in birds, discussed by Hussein et al. (1988), is a binding of aluminum sulfate with phosphate ions in the digestive tract, thereby preventing phosphate from being absorbed. It was actually a phosphorus deficiency, rather than the direct toxicity of aluminum, that caused the toxic effects observed in this study. However, the form of aluminum in soil and biota is not typically as bioavailable as aluminum sulfate and would probably not have the same capacity to bind to phosphate ions in the digestive tract as aluminum sulfate. Therefore, the hazard quotients calculated for aluminum in birds for this risk assessment are probably higher than if the hazard quotients had been derived from studies in which a form of aluminum similar to that occurring in soil and biota had been used. Therefore, while it cannot be concluded that aluminum dose not pose a potential risk, the aluminum hazard quotients for worm-eating birds were probably over-predictive of risk.

Although the hazard quotients for lead and vanadium were greater than one for the NOAEL using both the maximum and mean contaminant concentrations, the hazard quotients were not greater than one using the LOAEL. This indicates that the soil concentrations of lead and vanadium are already within the range of concentrations that would be set as preliminary

ecotoxicologically-based remedial goals since it is accepted that the ecotoxicologically-based remedial goal is between the NOAEL and the LOAEL. Furthermore, the hazard quotients using the NOAELs were relatively low (4.6 and 5.7 for lead using the mean and maximum concentrations, respectively, and 2.3 and 2.7 for vanadium using the mean and maximum concentrations, respectively).

Relating these results back to the original assessment endpoint in the ecological risk assessment, the data obtained for the current study indicate that survival, growth, and reproduction of worm-eating birds that feed in the vicinity of the Tar Dump and Hamill Road Dump Number 3 may be at risk from aluminum, lead, and vanadium. However, the hazard quotients were relatively low for each of these contaminants, the hazard quotient for aluminum was probably over-predictive of risk, and the hazard quotients for lead and vanadium did not exceed one using the LOAELs. Nevertheless, a lack of risk from aluminum, lead, and vanadium to worm-eating birds cannot be concluded.

5.2.4 Results and Conclusions of the Risk Characterization for Worm-Eating Mammals

The food chain model and chronic hazard quotient calculations for worm-eating mammals are presented in Table 21. Using the maximum concentrations for each contaminant of concern, it was determined that aluminum, manganese, and dieldrin resulted in hazard quotients greater than one when both the NOAELs and LOAELs were used. A hazard quotient greater than one was also calculated for lead and nickel when only the NOAEL was used. When the mean concentrations were used for these contaminants, virtually the same results were achieved, but with slightly lower hazard quotients, except that the hazard quotient for dieldrin using the LOAEL was less than one.

For aluminum, although the hazard quotients were greater than one for both the NOAEL and LOAEL using both the maximum and mean contaminant concentrations, the NOAEL and LOAEL for this contaminant may be over-protective. The values were derived from a study in which aluminum was administered in drinking water (Lal et al. 1993), indicating that the aluminum was in a very soluble, bioavailable form. Aluminum in soil and biota, however, is expected to be much less bioavailable. In addition to differences in the form and bioavailability of aluminum, the mechanism of toxicity may be overly conservative. Hussein et al. (1988) elucidated the mechanism of toxicity in birds to be an interaction with dietary phosphate where aluminum sulfate binds with phosphate ions in the digestive tract, thereby preventing phosphate from being absorbed. The resulting phosphorous deficiency caused the toxic effects observed in this study. Alsmeyer et al. (1963) has suggested that the mechanism of toxicity in mammals may also be related to an interaction with dietary phosphate. Since the form of aluminum in soil and biota at the site is not expected to be as bioavailable as the more soluble forms of aluminum and would probably not have the same capacity to bind to ions in the digestive tract of mammals, the hazard quotients calculated for aluminum in worm-eating mammals may be overly conservative.

Although the hazard quotients for manganese were greater than one for both the NOAEL and LOAEL using both the maximum and mean contaminant concentrations, the hazard quotients were relatively low (ranging from 1.04 for the LOAEL using the mean concentrations to 6.0 for the NOAEL using the maximum concentrations).

Although the hazard quotients for lead and nickel were greater than one for the NOAEL using both the mean and the maximum contaminant concentrations, these hazard quotients were not greater than one using the LOAELs. This indicates that the soil concentrations of

lead and nickel are already within the range of concentrations that would be set as preliminary ecotoxicologically-based remedial goals since it is accepted that the ecotoxicologically-based remedial goal is between the NOAEL and the LOAEL. Furthermore, the hazard quotients using the NOAELs were relatively low (1.2 and 1.5 for lead using the mean and maximum concentrations, respectively, and 4.1 and 5.4 for nickel using the mean and maximum concentrations, respectively).

For dieldrin, the hazard quotients were greater than one for both the NOAEL and LOAEL using the maximum dieldrin concentrations, but was greater than one only for the NOAEL when the mean dieldrin concentrations were used. Using the maximum concentrations, the hazard quotient calculated for the NOAEL was relatively high (31.8), but the hazard quotient calculated for the LOAEL was low (3.2). Furthermore, the hazard quotient using the mean concentrations and the NOAEL were also low (5.6) and the hazard quotient calculated for the LOAEL was less than one.

Relating these results back to the original assessment endpoint in the ecological risk assessment, the data obtained for the current study indicate that survival, growth, and reproduction of worm-eating mammals that feed in the vicinity of the Tar Dump and Hamill Road Dump Number 3 may be at risk from aluminum, lead, manganese, nickel, and dieldrin. However, the hazard quotients for manganese were relatively low, the hazard quotients for lead, nickel and dieldrin were relatively low and did not exceed one using the LOAELs, and the hazard quotients for aluminum were probably over-predictive of risk. Nevertheless, a lack of risk from aluminum, lead, manganese, nickel, and dieldrin to worm-eating mammals cannot be concluded.

6.0 UNCERTAINTY ANALYSIS

6.1 General Overview of Uncertainty Analysis

There are factors inherent in the risk assessment process that contribute to a level of uncertainty that must be considered when interpreting the results of a risk assessment. Major sources of uncertainty arise from the natural variability in biological and chemical systems, the introduction of error in the risk assessment process, and the presence of data gaps.

Natural variability is an inherent characteristic of ecological receptors, their stressors, and their combined behavior in the environment. Biotic and abiotic parameters in these systems may vary to such a degree that the exposure to ecological receptors in two identical conceptual models may differ temporally and spatially. Factors that contribute to temporal and spatial variability may be differences in an individual organism's behavior (within the same species), changes in the weather or ambient temperature, unanticipated interference from other stressors, differences between microenvironments, stochasticity, and numerous other factors. Thus, the conservative nature of this study assumes that the highly variable environmental conditions and the behavior of organisms and their stressors are interacting in such a manner that allows the contaminants to move freely through the identified exposure pathways, and to produce the same effects identified in the exposure profile.

Uncertainty associated with natural variability also arises from the use of literature toxicity values in which a study has examined a single species/single contaminant system under highly controlled conditions. If conducted in a laboratory, these studies do not take into account the effects of the environmental factors and other stressors that are present in natural systems. These factors may have synergistic, antagonistic, or neutral effects upon the receptor-contaminant interaction. Point estimates

of exposure such as NOAELs, LOAELs, LD50s, and mathematical means that are presented in the literature also have an inherent variability that is by default incorporated into the risk assessment.

In addition, uncertainty associated with natural variability is introduced from the use of literature values for sediment, water, and food ingestion rates, dietary compositions, and body weights. These values reported in the literature are from studies that may have been conducted at a certain time of year or in a certain location that does not necessarily give an accurate representation of the life histories of the species assessed at the site under consideration in the risk assessment.

Conservative assumptions were made in light of the uncertainty associated with the risk assessment process (e.g., natural variability). Conservative assumptions were used to minimize the possibility of concluding that risk is not present when a threat actually does exist (i.e., the elimination of false negatives). While there is uncertainty associated with each conservative assumption used, this consistent selection process ensures that the uncertainty associated with this type of error will err on the side of a protective outcome.

This study does not examine the contribution of dermal absorption, transfer across epithelial membranes, or inhalation exposure as part of the exposure pathway. In contrast to the use of conservative assumptions, the error introduced into this study by the omission of these routes of exposure may err on the side of a less protective outcome. The relative contribution of this error to alter the outcome of the risk assessment is unknown at this time.

Methodological problems in the literature reviewed for obtaining life history and toxicity information also introduce uncertainty into a risk assessment. Attempts are made to avoid using literature that is questionable. However, if no other sources of information exist, this error is incorporated into the risk assessment if the data are used.

Data gaps are defined here as the incompleteness of data or information upon which the risk assessment is based. Specifically, these may be an incomplete contaminant data set, missing pieces of life history information, and the absence of toxicity-based literature for the receptor of concern.

Life history information and literature values for the toxicity of the contaminants of concern are not always available for all the receptor species. By using closely related species, it is possible to make risk estimates. In reality, however, the information may vary substantially among species, thereby introducing another source of uncertainty.

In cases where a toxicity value has been converted by a factor of 10, the uncertainty associated with the absence of a directly relevant literature value is compounded by the uncertainty associated with a subjective mathematical adjustment.

6.2 Site-Specific Uncertainty Analysis

The results of the uncertainty analysis for this study are discussed next:

No acceptable studies on the dietary toxicity of any site contaminants to either the American robin or the short-tailed shrew were found. Therefore, dietary toxicity studies for representative receptors were used. An assumption was thereby made that the use of toxicity studies from representative receptors provides a similar and conservative approach to estimating the dietary exposure effects levels for the measurement. This was a source of additional uncertainty in the risk calculations using the food chain models.

Some uncertainty is associated with the NOAEL and LOAEL selected to evaluate manganese toxicity in birds. The NOAEL and LOAEL were derived from a study by Southern and Baker (1983), in which the measured endpoint was a decrease in body weight gain. In this study, the efficiency of feed utilization was not affected by the manganese concentrations, indicating that the decreased growth may be due to a decrease in food intake rather than a toxic effect. However, the NOAEL and LOAEL derived from this study were similar to some of the NOAELs and LOAELs obtained from other studies in which other effects (mild anemia) were noted at these concentrations. Therefore, the Southern and Baker (1983) study was selected because it provided the most conservative NOAELs and LOAELs of those that were available. Since the resulting hazard quotients were less than one, the uncertainty associated with the NOAEL and LOAEL does not affect the interpretation of risk posed by manganese to worm-eating birds.

The most appropriate study that was found on the dietary toxicity of aluminum to mammals was one in which aluminum was administered in drinking water to laboratory animals. Therefore, an assumption was made that exposure to aluminum in drinking water is a good representation of exposure to aluminum in food items. Since aluminum is not known to significantly bioaccumulate in biota, and since the form and availability of aluminum in soil and biota probably differ from the soluble form administered in drinking water, the assumption that these studies are representative of toxicity to upper trophic level receptors from ingestion of food sources contaminated with aluminum is conservative and possibly inappropriate. This introduced additional uncertainty into the hazard quotient calculations for the risk of aluminum to worm-eating mammals.

Similarly, the aluminum NOAEL and LOAEL for worm-eating birds were also based on studies in which a very bioavailable and soluble form of aluminum, aluminum sulfate, was used. Since aluminum is not expected to be in this form in soil and biota, this introduced additional uncertainty into the hazard quotient calculation for the risk of aluminum to worm-eating birds.

Another source of uncertainty results from the assumptions that were made concerning the dietary composition of the selected measurement endpoints. For the worm-eating birds and mammals, it was assumed that 100 percent of their diet consists of earthworms. The diets of these species are known to be more varied in reality compared with the assumptions used here. However, the actual diets of these species at the Chattanooga Creek site, as well as the degree of contamination in their actual diets, are unknown. This introduced uncertainty in the calculated contaminant dosages used in the hazard quotient calculations.

Soil ingestion rates for both the American robin and the short-tailed shrew could not be found in the literature. Therefore, estimated soil ingestion rates were based on the soil ingestion rate reported in the literature for the American woodcock. It was assumed that the soil ingestion rate of the American woodcock, as a percentage of total food ingestion, is representative of the true soil ingestion rates for the American robin and the short-tailed shrew. This assumptions introduced uncertainty into the calculation of risk for worm-eating mammals and birds.

Most of the toxicity values in the literature from chronic exposure studies were reported as a concentration of the contaminant in food. This concentration had to be converted to the appropriate dosage units of milligrams per kilogram body weight per day (mg/kg BW/day) for the food chain models. If the study in question did not report body weights and/or ingestion rates for the test animals, they were chosen from the literature or, in the case of ingestion rates, sometimes allometric equations had to be used. This introduced uncertainty in the NOAEL and LOAEL values, and thus in the hazard quotients for the risk characterization.

In the food chain model, the lowest reported body weights for adults and the highest reported ingestion rates were used in each case. Therefore, the dosage calculated may have been overestimated, thereby causing the hazard quotients to be overestimated for the receptor in question. However, the purpose of these assumptions was to provide a conservative estimate of the hazard quotient so as to protect the more sensitive species that fall within the assessment endpoint category (e.g., worm-eating birds). Nonetheless, these conservative assumptions introduced additional uncertainty into the risk characterization process.

In some cases, toxicity values in the literature were derived from data for which dosages were only reported as dry weight, and the authors did not give enough information to convert them to wet weight. The only such study that was used to derive a NOAEL or a LOAEL for the food chain models was Heath et al. (1972), from which the NOAEL and LOAEL for heptachlor toxicity to birds was derived. To convert the heptachlor dosages from this study to wet weight, it was assumed that the food administered in these studies consisted of one-third solids. This assumption was an approximation based on a variety of internal data from previous studies in which percent solids was measured in various biota samples. This was deemed to be a conservative assumption because it is probable that the feed used in the Heath et al. study contained less moisture than fresh tissue. Since this was a conservative assumption, and since the hazard quotients for heptachlor in birds were well below 1, this assumption did not introduce much uncertainty into the evaluation of risk from heptachlor to worm-eating birds. Indeed, when an even more conservative assumption of 10% solids is used, the hazard quotients for heptachlor would still have been less than one for worm-eating birds.

In the food chain model, bioavailability of each contaminant of concern was assumed to be 100 percent, and the contaminants were assumed not to be metabolized or excreted over the lifetime of the receptor. Therefore, the exposure dosages calculated in the food chain model may have been overestimated, thereby overestimating the hazard quotients. However, since the toxicity values obtained from the literature were based on applied dosages, rather than absorbed or assimilated dosages, this discrepancy theoretically cancels itself out in the hazard quotient equation. Nonetheless, this was an additional source of uncertainty in the hazard quotients calculated using the food chain model.

As discussed in Section 5.2.2, for the purposes of the food chain model, if a contaminant was not detected in a soil or earthworm sample, the contaminant was assumed to actually be present in the sample at one-tenth the detection limit for organics or one-half the detection limit for inorganics. This introduced additional uncertainty into the risk characterization for worm-eating mammals and birds.

7.0 CONCLUSIONS

- ◆ The observance of a distinct dose-response relationship in both the *C. tentans* and *H. azteca* toxicity tests clearly demonstrates that coal tar is causing direct toxicity to benthic invertebrates in Chattanooga Creek. Since evidence from the initial risk assessment suggests that benthic invertebrates are being exposed to coal tar contaminants in Chattanooga Creek, the weight of evidence suggests that coal tar is indeed posing a risk to the survival and reproduction of benthic invertebrates. Relating this back to the original assessment endpoint in the ecological risk assessment, the data obtained for the current study indicate that survival, growth, and reproduction of aquatic life in Chattanooga Creek are at risk from the coal tar deposits that are currently present in Chattanooga Creek.
- ◆ The food chain model and chronic hazard quotient calculations for worm-eating birds indicate a potential risk from aluminum using both the NOAEL and LOAEL and from lead and vanadium when only the NOAELs were used. Relating these results back to the original assessment endpoint in the ecological risk assessment, the data obtained for the current study indicate that survival, growth, and

reproduction of worm-eating birds that feed in the vicinity of the Tar Dump and Hamill Road Dump Number 3 may be at risk from aluminum, lead, and vanadium. However, lead and vanadium levels are already within an accepted ecotoxicologically-based remedial goal range, and the risk model assumptions for aluminum suggest that there is a high degree of uncertainty that ecological risk exists from this element.

- ◆ The food chain model and chronic hazard quotient calculations for worm-eating mammals indicate a potential risk from aluminum and manganese when both the NOAELs and LOAELs were used and from lead and nickel when only the NOAELs were used. A risk was also calculated from dieldrin when the maximum concentrations were used with both the NOAEL and LOAEL, but when the mean concentrations were used, a risk was only calculated using the NOAEL. Relating these results back to the original assessment endpoint in the ecological risk assessment, the data obtained for the current study indicate that survival, growth, and reproduction of worm-eating mammals that feed in the vicinity of the Tar Dump and Hamill Road Dump Number 3 may be at risk from aluminum, lead, manganese, nickel, and dieldrin. However, lead and nickel levels are already within an accepted ecotoxicologically-based remedial goal range, and the risk model assumptions for aluminum and manganese suggest that there is a high degree of uncertainty that ecological risk exists from these elements.

8.0 LITERATURE CITED

- Alsmeyer, W.L., B.G. Harmon, D.E. Becker, A.H. Jensen, and H.W. Norton. 1963. "Effects of Dietary Al and Fe on Phosphorus Utilization." Abstract of Papers for Presentation at the Meeting of the Midwestern Section A.S.A.S., Nov. 29-30, 1963, Chicago, IL.
- Barnthouse, L.W., et al. 1986. *User's Manual for Ecological Risk Assessment*. Publication Number 2679, ORNL-6251. Environmental Services Division, Oak Ridge National Laboratory, Oak Ridge, TN.
- HSDB (Hazardous Substances Data Bank). 1997. National Library of Medicine, Bethesda, Maryland (CD-ROM version), MICROMEDEX, Inc., Englewood, Colorado (Edition expires [1999]).
- Hussein, A.S., A.H. Cantor, and T.H. Johnson. 1988. "Use of High Levels of Dietary Aluminum and Zinc for Inducing Pauses in Egg Production of Japanese Quail." *Poultry Sci.*, 67:451-1165.
- Lal, B., A. Gupta, R.C. Murthy, M. Mohd Ali, and S.V. Chandra. 1993. "Aluminum Ingestion Alters Behaviour and Some Neurochemicals in Rats." *Indian J. Expt. Biol.*, 31:30-35.
- Laskey, J.W., G.L. Rehnberg, and J.F. Hein. 1982. "Effects of Chronic Manganese (Mn_3O_4) Exposure on Selected Reproductive Parameters in Rats." *J. Toxicol. Environ. Health*, 9:677-687.
- Roy F. Weston. 1996. "Draft Ecological Risk Assessment for Tennessee Products Site, Chattanooga, Tennessee." Prepared for the U.S. EPA, Contract No. 68-W9-0057.
- Southern, L.L and D.H. Baker. 1983. "*Eimeria acervulina* infection in chicks fed deficient or excess levels of manganese." *J. Nutr.* 113:172-177.
- U.S. EPA. 1989. "Protocols for Short Term Toxicity Screening of Hazardous Waste Sites." United States Environmental Protection Agency. Environmental Research Lab. Corvallis, OR. February 1989. EPA/600/3-88/029.
- U.S. EPA. 1994. "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates." United States Environmental Protection Agency, Office of Research and Development, Washington, D.C. EPA/600/R-94/024.
- U.S. EPA. 1997. "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final." OSWER 9285.7-25, PB97-963211. June 1997. EPA 540/R-97/006.
- Wisser, L.A., B.S. Heinrichs, and R.M. Leach. 1990. "Effect of aluminum on performance and mineral metabolism in young chicks and laying hens." *Am. J. of Nutrition*. 120:493-498.

Table 1. Results of the VOAs Analysis in Sediment (Dry Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a dry weight basis.

Sample No.	2384		2374		2375		2376		2385		2386		2387		2388	
Location/ID	Reference		REM-1		REM-2		ACTR		6%		12%		25%		50%	
% Moisture	29.0%		31.2%		20.7%		29.5%		29.2%		27.1%		32.4%		35.3%	
Analyte	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg
Trichlorofluoromethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Chloromethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Bromomethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Vinyl Chloride	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Chloroethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Methylene Chloride	U	64	U	73	U	570	U	500	U	71	U	69	U	62	U	70
1,1-Dichloroethene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Acetone	U	320	1100 J		5300 J		19000 J		U	350	U	340	U	340	U	350
Carbon Disulfide	U	32	U	36	U	290	U	250	U	35	U	34	U	31	U	35
1,1-Dichloroethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
cis-1,2-Dichloroethene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
2,2-Dichloropropane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Methyl Ethyl Ketone	U	320	U	360	U	2900	U	2500	U	350	U	340	U	310	U	350
Bromochloromethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Trans-1,2-Dichloroethene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Chloroform	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
1,2-Dichloroethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
1,1,1-Trichloroethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
1,1-Dichloropropene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Carbon Tetrachloride	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Bromodichloromethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Methyl Isobutyl Ketone	U	32	U	36	U	290	U	250	U	35	U	34	U	31	U	35
1,2-Dichloropropane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Dibromomethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Trans-1,3-Dichloropropene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Trichloroethene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Benzene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Dibromochloromethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
1,1,2-Trichloroethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
cis-1,3-Dichloropropene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Bromoform	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Bromobenzene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
1,1,2,2-Tetrachloroethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14

U = Material was analyzed for but not detected

J = Estimated value

Table 1 (cont'd.). Results of the VOAs Analysis in Sediment (Dry Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a dry weight basis.

Sample No.	2384		2374		2375		2376		2385		2386		2387		2388	
Location/ID	Reference		REM-1		REM-2		ACTR		6%		12%		25%		50%	
% Moisture	29.0%		31.2%		20.7%		29.5%		29.2%		27.1%		32.4%		35.3%	
Analyte	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg
Tetrachloroethene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
1,3-Dichloropropane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Methyl Butyl Ketone	U	32	U	36	U	290	U	250	U	35	U	34	U	31	U	35
Toluene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Chlorobenzene	U	13	11 J		730		48 J		U	14	9.8 J		37		59	
1,1,1,2-Tetrachloroethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Ethyl Benzene	U	13	U	15	30 J		U	100	U	14	U	14	U	12	U	14
M-and/or P- Xylene	U	13	U	15	81 J		U	100	U	14	U	14	U	12	4.1 J	
O-Xylene	U	13	U	15	41 J		U	100	U	14	U	14	3.2 J		4.1 J	
Styrene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
1,2,3-Trichloropropane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
O-Chlorotoluene	U	13	7 J		U	110	U	100	U	14	6.7 J		19		24	
P-Chlorotoluene	U	13	U	15	57 J		U	100	U	14	U	14	7.6 J		9.6 J	
1,3-Dichlorobenzene	U	13	U	15	65 J		U	100	U	14	U	14	20		25	
1,4-Dichlorobenzene	U	13	U	15	280		55 J		U	14	9.5 J		43		66	
1,2-Dichlorobenzene	U	13	U	15	72 J		U	100	U	14	4.1 J		13		16	
1,2-Dibromoethane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
Isopropylbenzene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
N-Propylbenzene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
1,3,5-Trimethylbenzene	U	13	U	15	72 J		U	100	U	14	U	14	5.5 J		5.8 J	
Tert-Butylbenzene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
1,2,4-Trimethylbenzene	U	13	5.2 J		130		U	100	U	14	3.9 J		9.7 J		11 J	
Sec-Butylbenzene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
P-Isopropyltoluene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
N-Butylbenzene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
1,2-Dibromo-3-Chloropropane	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
1,2,4-Trichlorobenzene	U	13	U	15	72 J		50 J		U	14	U	14	7.3 J		11 J	
Hexachloro-1,3-Butadiene	U	13	U	15	U	110	U	100	U	14	U	14	U	12	U	14
1,2,3-Trichlorobenzene	U	13	U	15	53 J		U	100	U	14	U	14	3.4 J		5.1 J	
Indane			90 JN		1000 JN						60 JN		100 JN		200 JN	

U = Material was analyzed for but not detected

J = Estimated value

N = Presumptive evidence of presence of material

Table 2. Results of the the BNAs Analysis in Sediment (Dry Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a dry weight basis.

Sample No.	2384		2374		2375		2376		2385		2386		2387		2388	
Location/ID	Reference		REM-1		REM-2		ACTR		6%		12%		25%		50%	
% Moisture	29.0%		33.2%		20.7%		29.5%		29.2%		27.1%		32.4%		35.3%	
Analyte	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg
Bis (2-Chloroethyl) Ether	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Hexachloroethane	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Bis (2-Chloroisopropyl) Ether	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
N-Nitrosodi-N-Propylamine	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Nitrobenzene	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Hexachlorobutadiene	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
2-Methylnaphthalene	U	890	190 J		1400		1200 J		150 J		480 J		1000		4200 J	
1,2,4-Trichlorobenzene	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Naphthalene	U	890	650 J		1600		2700 J		140 J		680 J		1100		6400 J	
4-Chloroaniline	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Bis(2-Chloroethoxy)Methane	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Isophorone	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Hexachlorocyclopentadiene	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
2-Chloronaphthalene	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
2-Nitroaniline	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Acenaphthylene	U	890	99 J		340 J		1900 J		130 J		100 J		330 J		1000 J	
Acenaphthene	U	890	780 J		3900		3300 J		420 J		1200		3200		U	9700
Dimethyl Phthalate	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Dibenzofuran	U	890	440 J		2800		2700 J		280 J		U	850	U	940	4900 J	
2,4-Dinitrotoluene	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
2,6-Dinitrotoluene	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
3-Nitroaniline	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
4-Chlorophenyl Phenyl Ether	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
4-Nitroaniline	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Fluorene	U	890	1000		4500		5500 J		570 J		1400		3600		9700 J	
Diethyl Phthalate	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
N-Nitrosodiphenylamine/Diphe	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Hexachlorobenzene	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
4-Bromophenyl Phenyl Ether	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Phenanthrene	520 J		4600		18000		21000		3800		4500		17000		34000	
Anthracene	U	890	900		3500		8800 J		740 J		1500		4100		11000	
Di-N-Butylphthalate	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Fluoranthene	1600		3500		17000		43000		6600		5200		19000		39000	
Pyrene	1000		2200		9600		27000		2500		3900		14000		20000	
Benzyl Butyl Phthalate	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Bis (2-Ethylhexyl) Phthalate	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Benzo(A)Anthracene	690 J		1300		4100		21000		2400		3200		10000		17000	

U = Material was analyzed for but not detected

J = Estimated value

Table 2 (cont'd.). Results of the BNAs Analysis in Sediment (Dry Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a dry weight basis.

Sample No.	2384		2374		2375		2376		2385		2386		2387		2388	
Location/ID	Reference		REM-1		REM-2		ACTR		6%		12%		25%		50%	
% Moisture	29.0%		33.2%		20.7%		29.5%		29.2%		27.1%		32.4%		35.3%	
Analyte	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg
Chrysene	850 J		990		3300		19000		1900		2800		7200		15000	
3,3-Dichlorobenzidine	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Di-N-Octylphthalate	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Benzo(B)Fluoranthene	620 J		950		2600		19000		3100		2900		8500		11000	
Benzo(K)Fluoranthene	530 J		390		1000		6900		1100		790 J		1800		8100 J	
Benzo-A-pyrene	610 J		830		2300		16000		2400		1800		5000		12000	
Indeno (1,2,3-CD) pyrene	370 J		640 J		1800		14000		1700		1500		3900		5700 J	
Dibenzo(A,H)Anthracene	100 J		160		430 J		3000		1100		350 J		980		2200 J	
Benzo(GH)perylene	350 J		480		1400		10000		1300		1200		3100		5100 J	
2-Chlorophenol	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
2-Methylphenol	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
3-and/or 4-Methylphenol	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
2-Nitrophenol	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Phenol	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
2,4-Dimethylphenol	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
2,4-Dichlorophenol	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
2,4,6-Trichlorophenol	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
2,4,5-Trichlorophenol	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
4-Chloro-3-Methylphenol	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
2,4-Dinitrophenol	U	1800	U	1800	U	1500	U	18000	U	1800	U	1700	U	1900	U	19000
2-Methyl-4,6-Dinitrophenol	U	1800	U	1800	U	1500	U	18000	U	1800	U	1700	U	1900	U	19000
Pentachlorophenol	U	1800	U	1800	U	1500	U	18000	U	1800	U	1700	U	1900	U	19000
4-Nitrophenol	U	1800	U	1800	U	1500	U	18000	U	1800	U	1700	U	1900	U	19000
2,3,4,6-Tetrachlorophenol	U	890	U	890	U	770	U	8900	U	900	U	850	U	940	U	9700
Carbazole	530 J		210 J		1500		920 J		410 J		380 J		1000		18000	
Benzo(a)fluoranthene (not B or K)	U	890	1000 JN		7000 JN		40000 JN								10000 JN	
Dimethylnaphthalene					800 JN											
Oxybis(methylene)bisbenzene					3000 JN											
Trimethylnaphthalene					1000 JN											
Methylfluorene					1000 JN											
Dibenzothiophene					3000 JN											
Methylphenanthrene					8000 JN											
Phenylindene					1000 JN											
Phenylnaphthalene					2000 JN											
Dimethylphenanthrene					900 JN											

U = Material was analyzed for but not detected
J = Estimated value
N = Presumptive evidence of presence of material

Table 3. Results of the TAL Metals Analysis in Sediment (Dry Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a dry weight basis.

Sample No.	2384		2374		2375		2376		2385		2386		2387		2388	
Location/ID	Reference		REM-1		REM-2		ACTR		6%		12%		25%		50%	
% Moisture	28%		30%		23%		40%		31%		32%		33%		37%	
Analyte	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg
Aluminum	9900 A		13000		9700		3600		11000		12000		14000		15000	
Antimony	U	0.20	U	0.20	U	0.20	U	0.40	U	0.40	0.48 A		0.39 A		0.70	
Arsenic	7.4		3.6		4.0		4.3		7.7		9.8 A		8.8		8.7	
Barium	66 A		66		52		34		78		78		87		88	
Beryllium	0.75 A		0.65		0.76		0.42		0.88		0.86		0.9		0.83	
Cadmium	0.51 A		0.32		0.41		0.26		0.63		0.72		1.0		1.2 A	
Calcium	3700		4400		13000		1800		4100		3800		5200		7800 A	
Chromium	55		22		50		56		71		81		99		100	
Cobalt	12 A		8.9		10		7.6		14		14		16		15	
Copper	20 A		8.9		15		14		66 A		29		44 A		46	
Iron	18000		15000		18000		12000		19000		20000		21000		20000	
Lead	53 A		17		32 A		50 A		61		59		62		58	
Magnesium	1200 A		1000		1700		420		1300		1400		1400		2500 A	
Manganese	710 A		400		520		330		820		770		730		630	
Mercury	0.080		0.060		0.14		0.080		0.13		0.24		0.48		0.81	
Molybdenum	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0
Nickel	22 A		14		16		12		27		29		38		42	
Potassium	970 A		800		920		360		1000		1100		1200		1200	
Selenium	0.72		0.59		U	0.70	U	0.50	0.94		0.79		1.3		1.5	
Silver	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0
Sodium	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100
Strontium	15 A		9.5		16		14		19		19 A		19		23	
Tellurium	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0
Thallium	U	0.2	0.21		U	0.20	U	0.20	U	0.20	U	0.20	0.21 A		0.22 A	
Tin	U	5.0	U	5.0	U	10	22 A		U	5.0	U	6.0	U	6.0	U	6.0
Titanium	53 A		68 A		58		56		54		49 A		71 A		59 A	
Vanadium	23		22		20		12		24		25		26		26	
Yttrium	7.7 A		9.7		8.3		4.1		9.2		9.2		9.9		10	
Zinc	140 A		42		71		70		160		170		180		180	

A = Average value

U = Material was analyzed for but not detected

Table 4. Results of the Pesticides/PCBs Analysis in Sediment (Dry Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a dry weight basis.

Sample No.	2384		2374		2375		2376		2385		2386		2387		2388	
Location/ID	Reference		REM-1		REM-2		ACTR		6%		12%		25%		50%	
% Moisture	29%		33%		21%		29%		29%		27%		32%		35%	
Analyte	Conc.	MDL	Conc.	MDL	Conc.	MDL	Conc.	MDL	Conc.	MDL	Conc.	MDL	Conc.	MDL	Conc.	MDL
	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Aldrin	U	7.0	U	7.1	U	15	U	530	U	7.2	U	6.8	U	19	U	19
Heptachlor	U	7.0	U	7.1	U	15	U	530	U	7.2	U	6.8	U	19	U	19
Heptachlor Epoxide	U	7.0	U	7.1	U	15	U	530	U	7.2	U	6.8	U	19	U	19
a-BHC	2.6 J		28		130		510 J		3.9 J		4.6		30		34	
b-BHC	U	7.0	24		27 J		1400 J		U	7.2	24		100		200	
g-BHC	U	7.0	U	7.1	U	15	U	530	U	7.2	U	6.8	U	19	U	19
d-BHC	U	7.0	4.9 N		30 J		1200 J		3.0 J		6.1 J		21 J		36 J	
Endosulfan I	U	7.0	U	7.1	U	15	U	530	U	7.2	U	6.8	U	19	U	19
Dieldrin	46		U	7.1	U	15	U	530	7.1 J		3.9 J		8.4 J		U	25
p,p'-DDT	U	18	U	28	U	39	U	1300	U	39	U	17	U	47	U	49
p,p'-DDE	U	7.0	U	7.1	U	39	U	530	U	7.2	U	6.8	U	19	U	19
p,p'-DDD	6.0 J		U	18	U	39	U	1300	U	18	U	17	U	47	U	49
Endrin	U	18	U	18	59 N		U	1300	U	18	U	17	U	47	U	49
Endosulfan II	U	18	U	18	U	39	U	1300	U	18	U	17	U	47	U	49
Endosulfan Sulfate	U	29	U	18	U	39	U	1300	U	25	U	24	U	47	U	49
Chlordane	U	44	U	45	U	97	U	3300	U	45	U	43	U	120	U	120
Toxaphene	U	710	U	710	U	1500	U	53000	U	720	U	680	U	1900	U	1900
Methoxychlor	U	40	U	45	U	97	U	3300	24		16 N		U	100	U	130
Endrin Ketone	U	18	U	18	U	39	U	1300	U	18	U	17	U	47	U	49
Arochlor 1016	U	89	U	100	U	190	U	6700	U	90	U	85	U	230	U	240
Arochlor 1221	U	89	U	100	U	190	U	6700	U	90	U	85	U	230	U	240
Arochlor 1232	U	89	U	100	U	190	U	6700	U	90	U	85	U	230	U	240
Arochlor 1242	U	89	U	100	U	190	U	6700	U	90	U	85	U	230	U	240
Arochlor 1248	U	89	U	100	U	190	U	6700	U	90	U	85	U	230	U	240
Arochlor 1254	U	89	U	100	U	190	U	6700	U	90	U	85	U	230	U	240
Arochlor 1260	U	89	U	100	U	190	U	6700	U	90	U	85	U	230	U	240

A = Average value

U = Material was analyzed for but not detected

J = Estimated value

N = Presumptive evidence of presence of material

Table 5. Results of the Oil and Grease Analysis in Sediment
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Sample	% Solids	Conc. (mg/kg, dw)	MDL (mg/kg, dw)	Conc. (mg/kg, ww)	MDL (mg/kg, ww)
Reference	67.4	351	10	237	6.74
6%	67.0	373	10	250	6.70
12%	70.0	533	10	373	7.00
25%	63.8	329	10	210	6.38
50%	65.1	1080	10	703	6.51
REM-1	70.1	257	10	180	7.01
REM-2	76.3	384	10	293	7.63
ACTR	66.7	570	10	380	6.67

Table 6. Results of the TOC Analysis in Sediment
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Sample	% TOC
Reference	9.12
6%	14
12%	6.47
25%	9.23
50%	9.02
REM-1	4.76
REM-2	4.52
ACTR	10.5

Table 7. Results of the Grain Size Analysis of Sediment
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Sample No.	001	006	007	008
Location/ID	Reference	REM-1	REM-2	ACTR
Gravel	3.37%	8.04%	12.30%	1.81%
Sand	66.96%	41.56%	67.77%	83.63%
Silt	13.98%	27.22%	9.59%	6.22%
Clay	15.69%	23.18%	10.34%	8.34%

Table 8. Results of the VOAs Analysis in Soil (Dry Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a dry weight basis.

Sample No.	2377		2378		2379		2380		2381		2382		2383	
Location/ID	Reference		S1		S2		S3		S4		S5		STA	
% Moisture	22.6%		33.4%		19.3%		43.1%		38.7%		34.0%		21.4%	
Analyte	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg
Trichlorofluoromethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Chloromethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Bromomethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Vinyl Chloride	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Chloroethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Methylene Chloride	U	65	U	75	U	56	U	80	U	82	U	95	U	11000
1,1-Dichloroethene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Acetone	U	320	U	380	U	280	U	330	U	410	2800 J		72000	
Carbon Disulfide	U	32	U	38	U	28	U	40	U	41	U	47	U	5300
1,1-Dichloroethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
cis-1,2-Dichloroethene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
2,2-Dichloropropane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Methyl Ethyl Ketone	U	320	U	380	U	280	U	400	U	410	U	470	U	53000
Bromochloromethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Trans-1,2-Dichloroethene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Chloroform	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,2-Dichloroethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,1,1-Trichloroethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,1-Dichloropropene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Carbon Tetrachloride	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Bromodichloromethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Methyl Isobutyl Ketone	U	32	U	38	U	28	U	40	U	41	U	47	U	5300
1,2-Dichloropropane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Dibromomethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Trans-1,3-Dichloropropene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Trichloroethene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Benzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Dibromochloromethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,1,2-Trichloroethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
cis-1,3-Dichloropropene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Bromoform	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Bromobenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,1,2,2-Tetrachloroethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100

U = Material was analyzed for but not detected

J = Estimated value

Table 8 (cont'd.). Results of the VOAs Analysis in Soil (Dry Weight)

Tennessee Products/Chattanooga Creek

Chattanooga, TN

February 1999

Data are reported on a dry weight basis.

Sample No.	2377		2378		2379		2380		2381		2382		2383	
Location/ID	Reference		S1		S2		S3		S4		S5		STA	
% Moisture	22.6%		33.4%		19.3%		43.1%		38.7%		34.0%		21.4%	
Analyte	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg
Tetrachloroethene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,3-Dichloropropane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Methyl Butyl Ketone	U	32	U	38	U	28	U	40	U	41	U	47	U	5300
Toluene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Chlorobenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,1,1,2-Tetrachloroethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Ethyl Benzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
M-and/or P- Xylene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
O-Xylene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Styrene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,2,3-Trichloropropane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
O-Chlorotoluene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
P-Chlorotoluene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,3-Dichlorobenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,4-Dichlorobenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,2-Dichlorobenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,2-Dibromoethane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Isopropylbenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
N-Propylbenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,3,5-Trimethylbenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Tert-Butylbenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,2,4-Trimethylbenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Sec-Butylbenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
P-Isopropyltoluene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
N-Butylbenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,2-Dibromo-3-Chloropropane	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,2,4-Trichlorobenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
Hexachloro-1,3-Butadiene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100
1,2,3-Trichlorobenzene	U	13	U	15	U	11	U	16	U	16	U	19	U	2100

U = Material was analyzed for but not detected

Table 9. Results of the BNAs Analysis in Soil (Dry Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a dry weight basis.

Sample No.	2377		2378		2379		2380		2381		2382		2383	
Location/ID	Reference		S1		S2		S3		S4		S5		STA	
% Moisture	22.6%		33.4%		29.3%		43.1%		38.7%		34.0%		21.5%	
Analyte	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg
Bis (2-Chloroethyl) Ether	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Hexachloroethane	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Bis (2-Chloroisopropyl) Ether	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
N-Nitrosodi-N-Propylamine	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Nitrobenzene	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Hexachlorobutadiene	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
2-Methylnaphthalene	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
1,2,4-Trichlorobenzene	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Naphthalene	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
4-Chloroaniline	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Bis(2-Chloroethoxy)Methane	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Isophorone	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Hexachlorocyclopentadiene	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
2-Chloronaphthalene	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
2-Nitroaniline	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Acenaphthylene	U	820	120 J		510 J		210 J		U	1000	120 J		340 J	
Acenaphthene	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Dimethyl Phthalate	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Dibenzofuran	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
2,4-Dinitrotoluene	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
2,6-Dinitrotoluene	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
3-Nitroaniline	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
4-Chlorophenyl Phenyl Ether	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
4-Nitroaniline	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Fluorene	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Diethyl Phthalate	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
N-Nitrosodiphenylamine/Diphenylamine	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Hexachlorobenzene	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
4-Bromophenyl Phenyl Ether	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Phenanthrene	150 J		370 J		1100		790 J		290 J		270 J		390 J	
Anthracene	U	820	92 J		520 J		220 J		U	1000	U	950	300 J	
Di-N-Butylphthalate	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Fluoranthene	370 J		1400		5000		3800		960 J		1200		3200	
Pyrene	230 J		990		2900		2100		670 J		820 J		1900	
Benzyl Butyl Phthalate	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Bis (2-Ethylhexyl) Phthalate	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Benzo(A)Anthracene	140 J		840 J		2600		1900		520 J		800 J		2100	

U = Material was analyzed for but not detected

J = Estimated value

Table 9 (cont'd.). Results of the BNAs Analysis in Soil (Dry Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a dry weight basis.

Sample No.	2377		2378		2379		2380		2381		2382		2383	
Location/ID	Reference		S1		S2		S3		S4		S5		STA	
% Moisture	22.6%		33.4%		29.3%		43.1%		38.7%		34.0%		21.5%	
Analyte	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg
Chrysene	220 J		920		3000		2000		600 J		790 J		2100	
3,3-Dichlorobenzidine	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Di-N-Octylphthalate	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Benzo(B)Fluoranthene	190 J		1100		3100		2000		600 J		1000		2300	
Benzo(K)Fluoranthene	91 J		300 J		1500		700 J		400 J		390 J		930	
Benzo-A-pyrene	130 J		730 J		2500		1400		480 J		680 J		1800	
Indeno (1,2,3-CD) pyrene	140 J		860 J		1700		1300		460 J		670 J		1600	
Dibenzo(A,H)Anthracene	U	820	200 J		680 J	J	310 J		110 J		150 J		380 J	
Benzo(GH)perylene	110 J		670 J		1500		920 J		340 J		490 J		1200	
2-Chlorophenol	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
2-Methylphenol	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
3-and/or 4-Methylphenol	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
2-Nitrophenol	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Phenol	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
2,4-Dimethylphenol	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
2,4-Dichlorophenol	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
2,4,6-Trichlorophenol	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
2,4,5-Trichlorophenol	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
4-Chloro-3-Methylphenol	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
2,4-Dinitrophenol	U	1600	U	1800	U	1700	U	1200	U	2000	U	1900	U	1500
2-Methyl-4,6-Dinitrophenol	U	1600	U	1800	U	1700	U	1200	U	2000	U	1900	U	1500
Pentachlorophenol	U	1600	U	1800	U	1700	U	1200	U	2000	U	1900	U	1500
4-Nitrophenol	U	1600	U	1800	U	1700	U	1200	U	2000	U	1900	U	1500
2,3,4,6-Tetrachlorophenol	U	820	U	910	U	870	U	1200	U	1000	U	950	U	740
Carbazole	U	820	U	910	1000		U	1200	U	1000	U	950	U	740
Benzo(a)fluoranthene (not B or K)			1000 JN		5000 JN		2000 JN				1000 JN		6000 JN	

U = Material was analyzed for but not detected

J = Estimated value

N = Presumptive evidence of presence of material

Table 10.1. Results of the TAL Metals Analysis in Soil (Dry Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a dry weight basis.

Sample No.	2377		2378		2379		2380		2381		2382		2383	
Location/ID	Reference		S1		S2		S3		S4		S5		STA	
% Moisture	23%		30%		30%		40%		37%		36%		23%	
Analyte	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg
Aluminum	12000		20000		18000		19000		18000		20000		18000	
Antimony	U	0.20	0.22		0.30		0.23		U	0.20	U	0.20	U	0.20
Arsenic	5.8		10		11		12		7.9		10		4.8	
Barium	78		130		120		110		110		100		99	
Beryllium	0.77		1.2		1.1		0.13		1.0		0.12		0.1	
Cadmium	0.46		0.57		0.69		0.73		0.6		0.52		0.56	
Calcium	1900		2400		2200		3000		2400		1500		1700	
Chromium	30		68		69		97		66		59		36	
Cobalt	15		22		21		16		18		19		14	
Copper	16		32		35		34		27		23		17	
Iron	16000		25000		23000		25000		21000		22000		19000	
Lead	59		74		80		81		66		52		32	
Magnesium	1000		1600		1400		1500		1400		1500		1400	
Manganese	840		2100		1300		670		1300		1000		1100	
Mercury	0.12		0.33		0.40		0.39		0.26		0.26		0.12	
Molybdenum	U	1.0	1.0		1.0		1.0		U	1.0	U	1.0	U	1.0
Nickel	21		37		31		32		36		31		21	
Potassium	920		1200		1300		1400		1400		1500		1300	
Selenium	0.78		1.5		1.6		1.7		U	1.0	1.4		U	1.0
Silver	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0
Sodium	U	100	U	100	U	100	U	100	U	100	U	100	U	100
Strontium	21		16		15		19		16		13		11	
Tellurium	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0
Thallium	U	0.20	0.25		U	0.20	U	0.20	U	0.20	U	0.20	U	0.20
Tin	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0
Titanium	58		80		86		70		59		84		84	
Vanadium	22		34		31		33		30		34		28	
Yttrium	9.1		14		13		14		12		13		12	
Zinc	97		160		170		180		170		140		98	

U = Material was analyzed for but not detected

Table 10.2. Results of the TAL Metals Analysis in Soil (Wet Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a wet weight basis.

Sample No.	2377		2378		2379		2380		2381		2382		2383	
Location/ID	Reference		S1		S2		S3		S4		S5		STA	
% Moisture	23%		30%		30%		40%		37%		36%		23%	
Analyte	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg
Aluminum	9200		14000		13000		11000		11000		13000		14000	
Antimony	U	0.15	0.15		0.21		0.14		U	0.13	U	0.13	U	0.15
Arsenic	4.5		7.0		7.7		7.2		5.0		6.4		3.7	
Barium	60		91		84		66		69		64		76	
Beryllium	0.59		0.84		0.77		0.078		0.63		0.077		0.077	
Cadmium	0.35		0.40		0.48		0.44		0.38		0.33		0.43	
Calcium	1500		1700		1500		1800		1500		960		1300	
Chromium	23		48		48		58		42		38		28	
Cobalt	12		15		15		9.6		11		12		11	
Copper	12		22		25		20		17		15		13	
Iron	12000		18000		16000		15000		13000		14000		15000	
Lead	45		52		56		49		42		33		25	
Magnesium	770		1100		980		900		880		960		1100	
Manganese	650		1500		910		400		820		640		850	
Mercury	0.092		0.23		0.28		0.23		0.16		0.17		0.092	
Molybdenum	U	0.77	0.70		0.70		0.60		U	0.63	U	0.64	U	0.77
Nickel	16		26		22		19		23		20		16	
Potassium	710		840		910		840		880		960		1000	
Selenium	0.60		1.1		1.1		1.0		U	0.63	0.90		U	0.77
Silver	U	0.77	U	0.70	U	0.70	U	0.60	U	0.63	U	0.64	U	0.77
Sodium	U	77	U	70	U	70	U	60	U	63	U	64	U	77
Strontium	16		11		11		11		10		8.3		8.5	
Tellurium	U	0.77	U	0.70	U	0.70	U	0.60	U	0.63	U	0.64	U	0.77
Thallium	U	0.15	0.18		U	0.14	U	0.12	U	0.13	U	0.13	U	0.15
Tin	U	3.9	U	3.5	U	3.5	U	3.0	U	3.2	U	3.2	U	3.9
Titanium	45		56		60		42		37		54		65	
Vanadium	17		24		22		20		19		22		22	
Yttrium	7.0		9.8		9.1		8.4		7.6		8.3		9.2	
Zinc	75		110		120		110		110		90		75	

U = Material was analyzed for but not detected

Table 11.1. Results of the Pesticides/PCBs Analysis in Soil (Dry Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a dry weight basis.

Sample No.	2377		2378		2379		2380		2381		2382		2383	
Location/ID	Reference		S1		S2		S3		S4		S5		STA	
% Moisture	23%		33%		29%		43%		39%		34%		22%	
Analyte	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg
Aldrin	U	6.6	U	7.3	U	17	U	9.5	U	8.2	U	7.6	U	30
Heptachlor	U	6.6	U	7.3	U	17	U	9.5	U	8.2	U	7.6	U	30
Heptachlor Epoxide	U	6.6	U	7.3	U	17	U	9.5	U	8.2	U	7.6	U	30
a-BHC	7.2 J		16		28		17		13		10		180	
b-BHC	U	6.6	6.2 J		34 J		31		19 J		18		48 J	
g-BHC	U	6.6	U	7.3	U	17	U	9.5	U	8.2	U	7.6	49 N	
d-BHC	U	6.6	U	16	18		8.8 N		6.1		7.8 JN		36	
Endosulfan I	U	6.6	U	7.3	U	43	U	9.5	U	8.2	U	7.6	U	30
Dieldrin	7.4 J		13 J		32		48		11 J		1.2 J		43	
p,p'-DDT	U	16	U	30	U	75	25 N		U	27	U	19	U	95
p,p'-DDE	U	16	U	7.3	U	17	U	9.5	U	8.2	U	7.6	U	30
p,p'-DDD	U	16	2.8 J		U	43	U	24	U	21	U	19	U	74
Endrin	U	16	U	18	U	43	U	24	U	21	U	19	U	74
Endosulfan II	U	16	U	18	U	43	U	24	U	21	U	19	U	74
Endosulfan Sulfate	U	16	U	29	U	43	U	24	U	21	U	24	U	74
Chlordane	U	41	U	46	U	110	U	60	U	51	U	47	U	180
Toxaphene	U	660	U	730	U	1700	U	950	U	820	U	760	U	3000
Methoxychlor	7.6 J		U	44	U	120	U	69	U	49	U	56	U	200
Endrin Ketone	U	16	U	18	U	43	U	24	U	21	U	19	U	74
Arochlor 1016	U	120	U	110	U	290	U	120	U	100	U	95	U	430
Arochlor 1221	U	120	U	110	U	290	U	120	U	100	U	95	U	430
Arochlor 1232	U	120	U	110	U	290	U	120	U	100	U	95	U	430
Arochlor 1242	U	120	U	110	U	290	U	120	U	100	U	95	U	430
Arochlor 1248	U	120	U	110	U	290	U	120	U	100	U	95	U	430
Arochlor 1254	U	120	U	110	U	290	U	120	U	100	U	95	U	430
Arochlor 1260	U	120	U	110	U	290	U	120	U	100	U	95	U	430

U = Material was analyzed for but not detected
J = Estimated value
N = Presumptive evidence of presence of material

Table 11.2. Results of the Pesticides/PCBs Analysis in Soil (Wet Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a wet weight basis.

Sample No.	2377		2378		2379		2380		2381		2382		2383	
Location/ID	Reference		S1		S2		S3		S4		S5		STA	
% Moisture	23%		33%		29%		43%		39%		34%		22%	
Analyte	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg	Conc. ug/kg	MDL ug/kg
Aldrin	U	5.1	U	4.9	U	12	U	5.4	U	5.0	U	5.0	U	23
Heptachlor	U	5.1	U	4.9	U	12	U	5.4	U	5.0	U	5.0	U	23
Heptachlor Epoxide	U	5.1	U	4.9	U	12	U	5.4	U	5.0	U	5.0	U	23
a-BHC	5.5 J		11		20		9.7		7.9		6.6		140	
b-BHC	U	5.1	4.2 J		24 J		18		12 J		12		37 J	
g-BHC	U	5.1	U	4.9	U	12	U	5.4	U	5.0	U	5.0	38 N	
d-BHC	U	5.1	U	11	13		5.0 N		3.7		5.1 JN		28	
Endosulfan I	U	5.1	U	4.9	U	31	U	5.4	U	5.0	U	5.0	U	23
Dieldrin	5.7 J		8.7 J		23		27		6.7 J		0.79 J		34	
p,p'-DDT	U	12	U	20	U	53	14 N		U	16	U	13	U	74
p,p'-DDE	U	12	U	4.9	U	12	U	5.4	U	5.0	U	5.0	U	23
p,p'-DDD	U	12	1.9 J		U	31	U	14	U	13	U	13	U	58
Endrin	U	12	U	12	U	31	U	14	U	13	U	13	U	58
Endosulfan II	U	12	U	12	U	31	U	14	U	13	U	13	U	58
Endosulfan Sulfate	U	12	U	19	U	31	U	14	U	13	U	16	U	58
Chlordane	U	32	U	31	U	78	U	34	U	31	U	31	U	140
Toxaphene	U	510	U	490	U	1200	U	540	U	500	U	500	U	2300
Methoxychlor	5.9 J		U	29	U	85	U	39	U	30	U	37	U	160
Endrin Ketone	U	12	U	12	U	31	U	14	U	13	U	13	U	58
Arochlor 1016	U	92	U	74	U	210	U	68	U	61	U	63	U	340
Arochlor 1221	U	92	U	74	U	210	U	68	U	61	U	63	U	340
Arochlor 1232	U	92	U	74	U	210	U	68	U	61	U	63	U	340
Arochlor 1242	U	92	U	74	U	210	U	68	U	61	U	63	U	340
Arochlor 1248	U	92	U	74	U	210	U	68	U	61	U	63	U	340
Arochlor 1254	U	92	U	74	U	210	U	68	U	61	U	63	U	340
Arochlor 1260	U	92	U	74	U	210	U	68	U	61	U	63	U	340

U = Material was analyzed for but not detected

J = Estimated value

N = Presumptive evidence of presence of material

Table 12. Results of the Oil and Grease Analysis in Soil
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a dry weight basis.

Sample	% Solids	Conc. (mg/kg)	MDL (mg/kg)
Reference	76.4	362	10
S-1	67.1	19.8	10
S-2	71.1	169	10
S-3	58.6	199	10
S-4	63.2	U	15.8
S-5	63.2	106	10
S-TA	76.3	30.5	10

U = Material was analyzed for but not detected

Table 13. Results of the TOC Analysis in Soil
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Sample	% TOC
Reference	14.6
S-1	10.2
S-2	11.2
S-3	11.8
S-4	9.48
S-5	7.41
S-TA	5.81

Table 14. Results of the Grain Size Analysis of Soil
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Sample No.	009	010	011	012	13	014	015
Location/ID	Reference	S-1	S-2	S-3	S-4	S-5	S-TA
Gravel	0%	0%	0%	0%	0%	0%	0%
Sand	35.22%	15.08%	7.02%	5.28%	21.37%	17.68%	23.41%
Silt	27.15%	35.50%	42.31%	44.06%	43.73%	37.69%	37.02%
Clay	37.63%	49.42%	50.67%	50.66%	34.90%	44.63%	39.57%

Table 15. Results of the *Hyalella azteca* Sediment Toxicity Test
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Sample	Mean % Survival	Mean Dry Weight (mg)
Control	90	0.055
Reference	85	0.041
6%	46.3*	0.051
12%	10*	0.061
25%	0*	N/A
50%	0*	N/A
ACTR	0*	N/A
REM-1	3.8*	0.031
REM-2	0*	N/A

* Statistically different from the control and the reference.

N/A - Not applicable because none of the organisms survived.

Table 16. Results of the *Chironomus tentans* Sediment Toxicity Test
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Sample	Mean % Survival	Mean Dry Weight (mg)
Control	87.5	1.092
Reference	81.3	1.049
6%	77.5	0.936
12%	61.3*	1.115
25%	7.5*	0.462*
50%	5*	0.148*
ACTR	0*	N/A
REM-1	80	0.986
REM-2	16.3*	0.868

* Statistically different from the control and the reference.

N/A - Not applicable because none of the organisms survived.

Table 17. Results of the Earthworm Toxicity Test
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Sample	% Survival	% Change in Average Weight
Positive Control	0	100
Negative Control *	90	-5.4
Reference	99	- 9.7
S-1	96	- 6.9
S-2	100	- 13.9
S-3	98	- 10.1
S-4	100	- 8.7
S-5	99	- 10.8
S-TA	100	- 11.6

* Due to laboratory limitations, only one test chamber with 20 worms was used for the negative control. Three test chambers with 40 worms each were used for all other treatments.

Table 18. Results of the TAL Metals Analysis in Earthworms (Wet Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a wet weight basis.

Sample No.	2882		2896		2892		2893	
Location/ID	Control		REF-1		REF-2		REF-3	
% Lipids	2.7%		3.1%		1.7%		1.6%	
% Moisture	81%		81%		82%		81%	
Analyte	Conc.	MDL	Conc.	MDL	Conc.	MDL	Conc.	MDL
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	320		270		260		300	
Antimony	U	2.9	U	2.0	U	1.9	U	2.0
Arsenic	U	0.37	0.26		0.28		0.29	
Barium	1.4		2.3		2.3		2.5	
Beryllium	U	0.36	U	0.25	U	0.24	U	0.25
Cadmium	0.37		0.76		0.81		0.77	
Calcium	510		630		650		670	
Chromium	U	0.73	2.0		1.4		1.3	
Cobalt	U	0.73	0.54		0.58		0.55	
Copper	1.5		3.7		2.5		2.2	
Iron	170		370		380		380	
Lead	U	2.9	U	2.0	U	1.9	U	2.0
Magnesium	300		160		160		150	
Manganese	5.0		18		20		20	
Mercury	U	0.10	U	0.10	U	0.10	U	0.10
Molybdenum	U	0.73	U	0.50	U	0.48	U	0.50
Nickel	U	1.5	1.8		2.0		2.0	
Potassium	1300		1500		1500		1400	
Selenium	0.74		0.79		0.73		0.77	
Silver	U	0.73	U	0.50	U	0.48	U	0.50
Sodium	800		700		760		670	
Strontium	1.2		1.5		1.6		1.6	
Thallium	U	7.3	U	5.0	U	4.8	U	5.0
Tin	U	2.2	U	1.5	U	1.4	U	1.5
Titanium	6.8		2.5		3.2		3.5	
Vanadium	U	0.73	U	0.50	0.52		0.58	
Yttrium	U	0.73	U	0.50	U	0.48	U	0.50
Zinc	22		22		22		22	

U = Material was analyzed for but not detected

Table 18 (cont'd.). Results of the TAL Metals Analysis in Earthworms (Wet Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a wet weight basis.

Sample No.	2881		2885		2895		2877		2886		2889	
Location/ID	S-1-1		S-1-2		S-1-3		S-2-1		S-2-2		S-2-3	
% Lipids	1.4%		7.2%		3.4%		5.3%		2.8%		5.0%	
% Moisture	84%		84%		87%		87%		84%		81%	
Analyte	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg
Aluminum	230		160		270		320		280		330	
Antimony	U	1.9	U	1.9	U	1.8	U	2.0	U	2.0	U	1.8
Arsenic	0.28		0.24		0.25		0.33		0.26		0.29	
Barium	2.2		1.6		2.3		3.0		2.3		2.9	
Beryllium	U	0.24	U	0.24	U	0.23	U	0.24	U	0.25	U	0.23
Cadmium	0.51		0.56		0.59		0.59		0.73		0.79	
Calcium	590		680		610		780		640		660	
Chromium	1.1		0.72		1.2		1.9		1.4		1.6	
Cobalt	U	0.48	U	0.48	U	0.46	1.4		U	0.50	0.60	
Copper	2.3		2.2		2.3		3.0		2.6		2.7	
Iron	310		230		350		410		350		430	
Lead	U	1.9	U	1.9	U	1.8	U	2.0	U	2.0	U	1.8
Magnesium	140		150		140		160		150		160	
Manganese	30		20		27		19		18		31	
Mercury	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10
Molybdenum	U	0.48	U	0.48	U	0.46	U	0.50	U	0.50	U	0.46
Nickel	1.4		1.3		1.6		2.1		1.6		2.0	
Potassium	1300		1500		1400		1500		1500		1500	
Selenium	0.72		0.79		0.74		0.61		0.68		0.67	
Silver	U	0.48	U	0.48	U	0.46	U	0.50	U	0.50	U	0.46
Sodium	720		830		720		900		740		800	
Strontium	1.4		1.6		1.5		1.8		1.4		1.5	
Thallium	U	4.8	U	4.8	U	4.6	U	4.9	U	5.0	U	4.6
Tin	U	1.4	U	1.4	U	1.4	U	1.5	U	1.5	U	1.4
Titanium	2.4		1.7		3.0		3.4		3.2		3.4	
Vanadium	U	0.48	U	0.48	0.49		0.60		0.50		0.61	
Yttrium	U	0.48	U	0.48	U	0.46	U	0.50	U	0.50	U	0.46
Zinc	20		21		21		25		22		24	

U = Material was analyzed for but not detected

Table 18 (cont'd.). Results of the TAL Metals Analysis in Earthworms (Wet Weight)

Tennessee Products/Chattanooga Creek

Chattanooga, TN

February 1999

Data are reported on a wet weight basis.

Sample No.	2879		2887		2891		2878		2880		2890	
Location/ID	S-3-1		S-3-2		S-3-3		S-4-1		S-4-2		S-4-3	
% Lipids	7.2%		5.7%		5.4%		4.9%		4.6%		1.7%	
% Moisture	82%		83%		85%		86%		84%		85%	
Analyte	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg
Aluminum	290		160		260		270		180		230	
Antimony	U	1.9	U	1.9	U	2.0	U	1.9	U	2.0	U	1.9
Arsenic	1.0		0.91		0.91		0.35		0.32		0.32	
Barium	2.8		1.7		2.4		2.5		1.7		2.2	
Beryllium	U	0.24	U	0.24	U	0.24	U	0.24	U	0.25	U	0.24
Cadmium	0.44		0.43		0.46		0.62		0.55		0.73	
Calcium	650		600		610		630		590		660	
Chromium	1.6		0.90		1.3		1.4		1.3		1.3	
Cobalt	0.83		0.90		1.1		1.1		0.82		0.88	
Copper	2.3		2.2		2.3		2.4		2.6		2.3	
Iron	390		220		330		380		240		310	
Lead	U	1.9	U	1.9	U	2.0	U	1.9	U	2.0	U	1.9
Magnesium	160		140		150		160		150		150	
Manganese	16		8.9		14		22		15		20	
Mercury	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10
Molybdenum	U	0.49	U	0.48	U	0.49	U	0.48	U	0.50	U	0.48
Nickel	1.5		U	0.97	1.3		1.8		1.4		1.6	
Potassium	1500		1600		1500		1600		1600		1500	
Selenium	0.88		0.92		0.88		0.78		0.87		0.79	
Silver	U	0.49	U	0.48	U	0.49	U	0.48	U	0.50	U	0.48
Sodium	700		880		880		780		840		840	
Strontium	1.7		1.5		1.6		1.6		1.4		1.6	
Thallium	U	4.9	U	4.8	U	4.9	U	4.8	U	5.0	U	4.8
Tin	U	1.4	U	1.4	U	1.5	U	1.4	U	1.5	U	1.4
Titanium	3.1		1.8		3.0		3.1		2.0		2.4	
Vanadium	0.55		U	0.48	0.49		0.50		U	0.50	U	0.48
Yttrium	U	0.49	U	0.48	U	0.49	U	0.48	U	0.50	U	0.48
Zinc	22		22		22		23		22		22	

U = Material was analyzed for but not detected

Table 18 (cont'd.) Results of the TAL Metals Analysis in Earthworms (Wet Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a wet weight basis.

Sample No.	2876		2883		2888		2884		2894		2897	
Location/ID	S-5-1		S-5-2		S-5-3		S-TA-1		S-TA-2		S-TA-3	
% Lipids	5.0%		5.2%		2.3%		2.7%		7.6%		10.3%	
% Moisture	84%		84%		85%		84%		85%		86%	
Analyte	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg
Aluminum	13		240		130		130		130		180	
Antimony	U	1.9	U	2.0	U	2.0	U	1.7	U	1.9	U	1.8
Arsenic	0.47		0.38		0.28		0.21		0.24		0.22	
Barium	U	0.48	2.2		1.5		1.4		1.4		1.6	
Beryllium	U	0.24	U	0.25	U	0.25	U	0.21	U	0.24	U	0.23
Cadmium	8.9		0.45		0.56		0.75		0.79		0.72	
Calcium	250		580		680		660		650		670	
Chromium	U	0.48	1.1		0.75		0.63		0.86		1.1	
Cobalt	U	0.48	1.2		0.89		U	0.43	U	0.50	U	0.46
Copper	12		2.1		2.2		3.1		2.2		2.4	
Iron	490		310		180		200		200		240	
Lead	U	1.9	U	2.0	U	2.0	U	1.7	U	1.9	U	1.8
Magnesium	390		140		140		140		140		140	
Manganese	2.8		13		8.0		13		12		14	
Mercury	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10
Molybdenum	U	0.48	U	0.49	U	0.50	U	0.43	U	0.50	U	0.46
Nickel	U	0.96	1.3		U	1.0	1.2		1.2		1.1	
Potassium	4000		1400		1400		1500		1400		1400	
Selenium	0.96		0.85		0.84		0.67		0.64		0.71	
Silver	U	0.48	U	0.49	U	0.50	U	0.43	U	0.50	U	0.46
Sodium	3100		660		730		750		770		740	
Strontium	1.9		1.4		1.5		1.4		1.3		1.4	
Thallium	U	4.8	U	4.9	U	5.0	U	4.3	U	5.0	U	4.6
Tin	U	1.4	U	1.5	U	1.5	U	1.3	U	1.4	U	1.4
Titanium	U	0.48	2.2		1.3		1.4		1.3		1.6	
Vanadium	U	0.48	U	0.49	U	0.50	U	0.43	U	0.50	U	0.46
Yttrium	U	0.48	U	0.49	U	0.50	U	0.43	U	0.50	U	0.46
Zinc	44		20		19		21		20		20	

U = Material was analyzed for but not detected

Table 19. Results of the Pesticides/PCBs Analysis in Earthworms (Wet Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a wet weight basis.

Sample No.	2882		2896		2892		2893	
Location/ID	Control		REF-1		REF-2		REF-3	
% Lipids	2.7%		3.1%		1.7%		1.6%	
% Moisture	81%		81%		82%		81%	
Analyte	Conc.	MDL	Conc.	MDL	Conc.	MDL	Conc.	MDL
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aldrin	U J	0.050	U	0.050	U	0.050	U J	0.050
Heptachlor	U J	0.050	U	0.050	U	0.050	U J	0.050
Heptachlor Epoxide	U J	0.050	U	0.050	U	0.050	U J	0.050
a-BHC	U J	0.050	U	0.050	U	0.050	U J	0.050
b-BHC	U J	0.050	U	0.050	U	0.050	U J	0.050
g-BHC	U J	0.050	U	0.050	U	0.050	U J	0.050
d-BHC	U J	0.050	U	0.050	U	0.050	U J	0.050
Endosulfan I	U J	0.050	U	0.050	U	0.050	U J	0.050
Dieldrin	U J	0.050	U	0.050	U	0.050	U J	0.050
p,p'-DDT	U J	0.056	U	0.054	U	0.059	U J	0.055
p,p'-DDE	U J	0.050	U	0.050	U	0.050	U J	0.050
p,p'-DDD	U J	0.050	U	0.050	U	0.050	U J	0.050
Endrin	U J	0.050	U	0.050	U	0.050	U J	0.050
Endosulfan II	U J	0.050	U	0.050	U	0.050	U J	0.050
Endosulfan Sulfate	U J	0.056	U	0.054	U	0.059	U J	0.055
Chlordane	U J	0.20	U	0.20	U	0.20	U J	0.20
Toxaphene	U J	3.0	U	3.0	U	3.0	U J	3.0
Methoxychlor	U J	0.20	U	0.20	U	0.20	U J	0.20
Endrin Ketone	U J	0.050	U	0.054	U	0.059	U J	0.055
Arochlor 1016	U J	0.50	U	0.50	U	0.50	U J	0.50
Arochlor 1221	U J	0.50	U	0.50	U	0.50	U J	0.50
Arochlor 1232	U J	0.50	U	0.50	U	0.50	U J	0.50
Arochlor 1242	U J	0.50	U	0.50	U	0.50	U J	0.50
Arochlor 1248	U J	0.50	U	0.50	U	0.50	U J	0.50
Arochlor 1254	U J	0.50	U	0.50	U	0.50	U J	0.50
Arochlor 1260	U J	0.50	U	0.50	U	0.50	U J	0.50

U = Material was analyzed for but not detected

J = Estimated value

Table 19 (cont'd.). Results of the Pesticides/PCBs Analysis in Earthworms (Wet Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a wet weight basis.

Sample No.	2881		2885		2895		2877		2886		2889	
Location/ID	S-1-1		S-1-2		S-1-3		S-2-1		S-2-2		S-2-3	
% Lipids	1.4%		7.2%		3.4%		5.3%		2.8%		5.0%	
% Moisture	84%		84%		87%		84%		84%		81%	
Analyte	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg
Aldrin	U	0.050	U J	0.050	U	0.050	U	0.050	U	0.050	U	0.050
Heptachlor	U	0.050	U J	0.050	U	0.050	0.037		U	0.050	U	0.050
Heptachlor Epoxide	U	0.050	U J	0.050	U	0.050	U	0.062	U	0.050	U	0.053
a-BHC	U	0.050	U J	0.050	U	0.050	U	0.050	U	0.050	U	0.050
b-BHC	U	0.050	U J	0.050	U	0.050	U	0.050	U	0.050	U	0.050
g-BHC	U	0.050	U J	0.050	U	0.050	U	0.050	U	0.050	U	0.050
d-BHC	U	0.050	U J	0.050	U	0.050	U	0.050	U	0.050	U	0.050
Endosulfan I	U	0.050	U J	0.050	U	0.050	U	0.050	U	0.050	U	0.050
Dieldrin	U	0.050	U J	0.050	U	0.050	0.076		U	0.050	U	0.094
p,p'-DDT	U	0.061	U J	0.054	U	0.060	U	0.11	U	0.050	U	0.11
p,p'-DDE	U	0.050	U J	0.050	U	0.050	U	0.050	U	0.050	U	0.050
p,p'-DDD	U	0.050	U J	0.050	U	0.050	U	0.088	U	0.050	U	0.085
Endrin	U	0.050	U J	0.050	U	0.050	U	0.088	U	0.050	U	0.085
Endosulfan II	U	0.050	U J	0.050	U	0.050	0.040 J		U	0.050	U	0.085
Endosulfan Sulfate	U	0.061	U J	0.054	U	0.060	U	0.11	U	0.050	U	0.11
Chlordane	U	0.20	U J	0.20	U	0.20	U	0.27	U	0.20	U	0.27
Toxaphene	U	3.0	U J	3.0	U	3.0	U	4.4	U	3.0	U	4.2
Methoxychlor	U	0.20	U J	0.20	U	0.20	U	0.22	U	0.20	U	0.21
Endrin Ketone	U	0.061	U J	0.054	U	0.060	U	0.11	U	0.050	U	0.11
Arochlor 1016	U	0.50	U J	0.50	U	0.50	U	0.55	U	0.50	U	0.53
Arochlor 1221	U	0.50	U J	0.50	U	0.50	U	0.55	U	0.50	U	0.53
Arochlor 1232	U	0.50	U J	0.50	U	0.50	U	0.55	U	0.50	U	0.53
Arochlor 1242	U	0.50	U J	0.50	U	0.50	U	0.55	U	0.50	U	0.53
Arochlor 1248	U	0.50	U J	0.50	U	0.50	U	0.55	U	0.50	U	0.53
Arochlor 1254	U	0.50	U J	0.50	U	0.50	U	0.55	U	0.50	U	0.53
Arochlor 1260	U	0.50	U J	0.50	U	0.50	U	0.55	U	0.50	U	0.53

U = Material was analyzed for but not detected

J = Estimated value

Table 19 (cont'd.) Results of the Pesticides/PCBs Analysis in Earthworms (Wet Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a wet weight basis.

Sample No.	2879		2887		2891		2878		2880		2890	
Location/ID	S-3-1		S-3-2		S-3-3		S-4-1		S-4-2		S-4-3	
% Lipids	7.2%		5.7%		5.4%		4.9%		4.6%		1.7%	
% Moisture	82%		83%		85%		86%		84%		85%	
Analyte	Conc.	MDL	Conc.	MDL	Conc.	MDL	Conc.	MDL	Conc.	MDL	Conc.	MDL
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aldrin	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U J	0.050
Heptachlor	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U J	0.050
Heptachlor Epoxide	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U J	0.050
a-BHC	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U J	0.050
b-BHC	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U J	0.050
g-BHC	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U J	0.050
d-BHC	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U J	0.050
Endosulfan I	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U J	0.050
Dieldrin	0.049		U	0.062	U	0.078	U	0.050	U	0.050	U J	0.050
p,p'-DDT	U	0.051	U	0.057	U	0.071	U	0.070	U	0.063	U J	0.050
p,p'-DDE	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U J	0.050
p,p'-DDD	U	0.050	U	0.050	U	0.057	U	0.056	U	0.051	U J	0.050
Endrin	U	0.050	U	0.050	U	0.057	U	0.056	U	0.051	U J	0.050
Endosulfan II	U	0.050	U	0.050	U	0.057	U	0.056	U	0.051	U J	0.050
Endosulfan Sulfate	U	0.051	U	0.057	U	0.071	U	0.070	U	0.063	U J	0.050
Chlordane	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U J	0.20
Toxaphene	U	3.0	U	3.0	U	3.0	3.0		U	3.0	U J	3.0
Methoxychlor	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U J	0.26
Endrin Ketone	U	0.051	U	0.057	U	0.071	U	0.070	U	0.063	U J	0.050
Arochlor 1016	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U J	0.50
Arochlor 1221	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U J	0.50
Arochlor 1232	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U J	0.50
Arochlor 1242	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U J	0.50
Arochlor 1248	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U J	0.50
Arochlor 1254	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U J	0.50
Arochlor 1260	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U J	0.50

U = Material was analyzed for but not detected

J = Estimated value

Table 19 (cont'd.). Results of the Pesticides/PCBs Analysis in Earthworms (Wet Weight)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

Data are reported on a wet weight basis.

Sample No.	2876		2883		2888		2884		2894		2897	
Location/ID	S-5-1		S-5-2		S-5-3		S-TA-1		S-TA-2		S-TA-3	
% Lipids	5.0%		5.2%		2.3%		2.7%		7.6%		10.3%	
% Moisture	84%		84%		85%		84%		85%		86%	
Analyte	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg	Conc. mg/kg	MDL mg/kg
Aldrin	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.056
Heptachlor	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.056
Heptachlor Epoxide	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.056
a-BHC	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.056
b-BHC	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.056
g-BHC	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.056
d-BHC	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.056
Endosulfan I	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.056
Dieldrin	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.056
p,p'-DDT	U	0.077	U	0.050	U	0.050	U	0.054	U	0.056	U	0.14
p,p'-DDE	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.056
p,p'-DDD	U	0.062	U	0.050	U	0.050	U	0.050	U	0.050	U	0.14
Endrin	U	0.062	U	0.050	U	0.050	U	0.050	U	0.050	U	0.14
Endosulfan II	U	0.062	U	0.050	U	0.050	U	0.050	U	0.050	U	0.14
Endosulfan Sulfate	U	0.077	U	0.050	U	0.050	U	0.054	U	0.056	U	0.14
Chlordane	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.35
Toxaphene	U	3.1	U	3.0	U	3.0	U	3.0	U	3.0	U	5.6
Methoxychlor	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.28
Endrin Ketone	U	0.077	U	0.050	U	0.050	U	0.054	U	0.056	U	0.056
Arochlor 1016	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.71
Arochlor 1221	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.71
Arochlor 1232	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.71
Arochlor 1242	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.71
Arochlor 1248	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.71
Arochlor 1254	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.71
Arochlor 1260	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.71

U = Material was analyzed for but not detected

Table 20. Hazard Quotient Calculations for Worm-Eating Birds (American Robin)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

BASED ON MAXIMUM CONCENTRATIONS:

Metal	Maximum Soil Conc. (mg/kg)	Max. Conc. in Earthworms (mg/kg)	Ingestion Rate (kg/day)	Soil Ing. Rate (kg/day)	AUF	Body Weight (1/kg)	Dose from Soil (mg/kg/day)	Dose from Earthworms (mg/kg/day)	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	HQ (NOAEL)	HQ (LOAEL)
Aluminum	14000	330	0.0087	0.00090	1.0	12.9	163	37	199.58	92.5	171	2.2	1.2
Chromium	58	1.9	0.0087	0.00090	1.0	12.9	0.7	0.2	0.89	1.0	10	0.9	0.1
Lead	56	1.0	0.0087	0.00090	1.0	12.9	0.7	0.1	0.76	0.133	1.33	5.7	0.6
Manganese	1500	31	0.0087	0.00090	1.0	12.9	17	3	20.89	200	370	0.1	0.1
Mercury	0.28	0.05	0.0087	0.00090	1.0	12.9	0.003	0.01	0.0089	0.07	0.7	0.1	0.0
Nickel	26	2.1	0.0087	0.00090	1.0	12.9	0.3	0.2	0.54	30	132	0.0	0.0
Vanadium	24	0.61	0.0087	0.00090	1.0	12.9	0.3	0.07	0.35	0.13	1.3	2.7	0.3
Zinc	120	44	0.0087	0.00090	1.0	12.9	1	5	6.33	13.9	139	0.5	0.0
DDT	0.014	0.014	0.0087	0.00090	1.0	12.9	0.0002	0.002	0.002	0.19	2.04	0.0	0.0
Dieldrin	0.034	0.076	0.0087	0.00090	1.0	12.9	0.0004	0.01	0.009	0.1	0.3	0.1	0.0
Endrin	0.0058	0.014	0.0087	0.00090	1.0	12.9	0.0001	0.002	0.002	0.12	0.367	0.0	0.0
Heptachlor	0.0023	0.037	0.0087	0.00090	1.0	12.9	0.00003	0.004	0.004	0.03	0.34	0.1	0.0

BASED ON MEAN CONCENTRATIONS:

Metal	Mean Soil Conc. (mg/kg)	Mean Conc. in Earthworms (mg/kg)	Ingestion Rate (kg/day)	Soil Ing. Rate (kg/day)	AUF	Body Weight (1/kg)	Dose from Soil (mg/kg/day)	Dose from Earthworms (mg/kg/day)	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	HQ (NOAEL)	HQ (LOAEL)
Aluminum	13000	210	0.0087	0.00090	1.0	12.9	151	24	174.50	92.5	171	1.9	1.02
Lead	43	0.95	0.0087	0.00090	1.0	12.9	0.50	0.11	0.61	0.133	1.33	4.6	0.5
Vanadium	22	0.35	0.0087	0.00090	1.0	12.9	0.26	0.04	0.29	0.13	1.3	2.3	0.2

1) All soil and tissue concentrations are in mg/kg, wet weight.

2) If a contaminant was not detected in a sample, it was assumed that the contaminant was actually present in the sample at one-tenth the detection limit for organics and one-half the detection limit for inorganics.

Table 21. Hazard Quotient Calculations for Worm-Eating Mammals (Short-tailed shrew)
Tennessee Products/Chattanooga Creek
Chattanooga, TN
February 1999

BASED ON MAXIMUM CONCENTRATIONS:

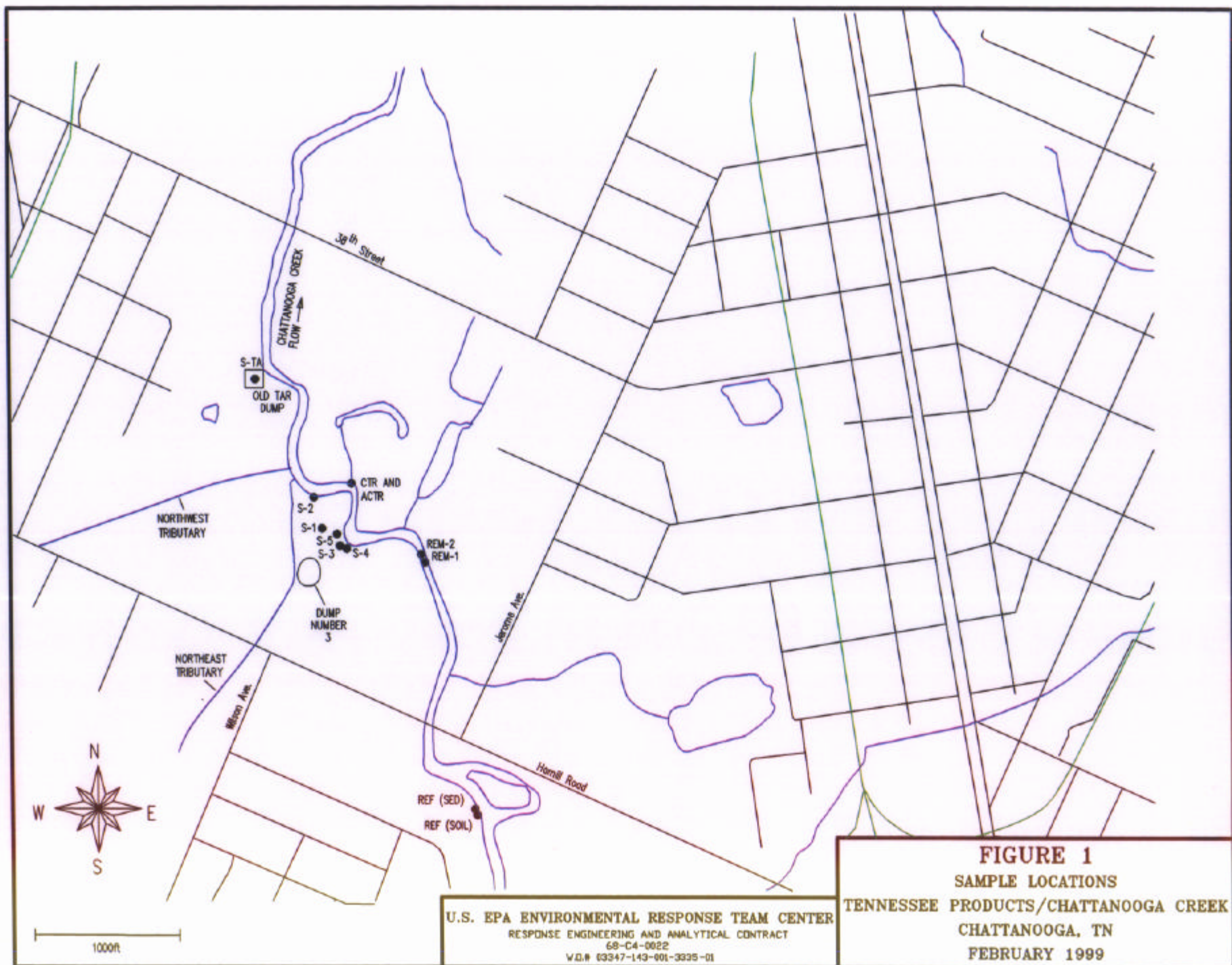
Metal	Maximum Soil Conc. (mg/kg)	Max. Conc. in Earthworms (mg/kg)	Ingestion Rate (kg/day)	Soil Ing. Rate (kg/day)	AUF	Body Weight (1/kg)	Dose from Soil (mg/kg/day)	Dose from Earthworms (mg/kg/day)	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	HQ (NOAEL)	HQ (LOAEL)
Aluminum	14000	330	0.00795	0.00246	1.0	83.3	2869	219	3087.39	5.5	55	561.3	56.1
Lead	56	1.0	0.00795	0.00246	1.0	83.3	11.5	0.7	12.14	8	80	1.5	0.2
Manganese	1500	31	0.00795	0.00246	1.0	83.3	307	21	327.91	55	178	6.0	1.8
Nickel	26	2.1	0.00795	0.00246	1.0	83.3	5.3	1.4	6.72	1.25	12.5	5.4	0.5
Zinc	120	44	0.00795	0.00246	1.0	83.3	24.6	29	53.73	160	320	0.3	0.2
b-BHC	0.037	0.0056	0.00795	0.00246	1.0	83.3	0.008	0.004	0.01	0.5	5	0.0	0.0
g-BHC	0.038	0.0056	0.00795	0.00246	1.0	83.3	0.008	0.004	0.01	0.05	0.5	0.2	0.0
Dieldrin	0.034	0.076	0.00795	0.00246	1.0	83.3	0.007	0.050	0.06	0.0018	0.018	31.8	3.2

BASED ON MEAN CONCENTRATIONS:

Metal	Mean Soil Conc. (mg/kg)	Mean Conc. in Earthworms (mg/kg)	Ingestion Rate (kg/day)	Soil Ing. Rate (kg/day)	AUF	Body Weight (1/kg)	Dose from Soil (mg/kg/day)	Dose from Earthworms (mg/kg/day)	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	HQ (NOAEL)	HQ (LOAEL)
Aluminum	13000	210	0.00795	0.00246	1.0	83.3	2664	139	2803.00	5.5	55	509.6	51.0
Lead	43	0.95	0.00795	0.00246	1.0	83.3	9	1	9.44	8	80	1.2	0.1
Manganese	850	17	0.00795	0.00246	1.0	83.3	174	11	185.44	55	178	3.4	1.04
Nickel	21	1.3	0.00795	0.00246	1.0	83.3	4.3	0.9	5.16	1.25	12.5	4.1	0.4
Dieldrin	0.0167	0.01	0.00795	0.00246	1.0	83.3	0.003	0.007	0.01	0.0018	0.018	5.6	0.6

1) All soil and tissue concentrations are in mg/kg, wet weight.

2) If a contaminant was not detected in a sample, it was assumed that the contaminant was actually present in the sample at one-tenth the detection limit for organics and one-half the detection limit for inorganics.



APPENDIX A

Final Report for the *Hyaella azteca* and *Chironomus tentans* Sediment Toxicity Tests
Tennessee Products/Chattanooga Creek Superfund Site
Chattanooga, TN
February 1999

WESTON TENNESSEE PRODUCTS SEDIMENT TOXICITY TESTING

Contents

<u>Section</u>	<u>Page</u>
Introduction	01
SEDIMENT EXPOSURES - <i>HYALELLA AZTECA</i>	
Materials and Methods	03
Results	07
SEDIMENT EXPOSURES - <i>CHIRONOMUS TENTANS</i>	
Materials and Methods	10
Results	14

Tables

I.	Summary of Chemical Analyses for Tennessee Products	02
II.	Summary of Conditions for <i>Hyaella azteca</i> Toxicity Test	06
III.	Percent survival of <i>H. azteca</i> by replicate chamber and mean survival	09
IV.	Dry weight (mg) of <i>H. azteca</i> by replicate chamber and mean dry weight	09
V.	Summary of Conditions for <i>Chironomus tentans</i> Toxicity Test	13
VI.	Percent survival of <i>C. tentans</i> by replicate chamber and mean survival	16
VII.	Dry weight (mg) of <i>C. tentans</i> by replicate chamber and mean dry weight	16

Appendices

A.	Raw data for oil and grease (SW46-9071) and loss on ignition (AASHTO T 267-86)
B.	Raw data for <i>Hyaella azteca</i> 14 day survival and growth test
C.	Statistical data for <i>Hyaella azteca</i> 14 day survival and growth test using laboratory control sediment
D.	Statistical data for <i>Hyaella azteca</i> 14 day survival and growth test using Tennessee Products reference sediment
E.	Raw data for <i>Chironomus tentans</i> 14 day survival and growth test
F.	Statistical data for <i>Chironomus tentans</i> 14 day survival growth test using laboratory control sediment
G.	Statistical data for <i>Chironomus tentans</i> 14 day survival growth test using Tennessee Products reference sediment

WESTON TENNESSEE PRODUCTS SEDIMENT TOXICITY TESTING

INTRODUCTION

During the month of February, 1998, samples of sediment were collected from the Tennessee Products site in Chattanooga, Tennessee. These sediment samples were used to perform preliminary toxicity tests to determine if the tested matrices represent a significant threat to potential receptor organisms as well as to evaluate several chemical parameters; oil and grease, loss on ignition and percent solids.

The sediment samples from the site were evaluated for toxicity using a 14-day solid phase exposure using the freshwater invertebrates *Chironomus tentans* and *Hyalella azteca* [1]. Following the exposure period, surviving test organisms from the sediments collected at the site were compared to a control set tested under similar conditions using a sediment of known environmental quality (Spruce Run Reservoir). The endpoints used for determination of an impact were mortality, measured as mean survival and growth, measured as mean dry weight.

CHEMICAL ANALYSIS

A total of 15 sediment samples were collected from the Tennessee Products site to be evaluated for oil and grease, expressed as dry weight and loss on ignition and percent solids expressed as a percentage of the total sample. The summary of those analyses are found in Table I.

All raw data for the chemical analyses are located in Appendix A.

Table I. Summary of Chemical Analyses for Tennessee Products

Sample ID	Sample Location	Sample Collection Date	Oil & Grease Dry Weight MDL 10.0 mg/kg	% Solids MDL 0.01 %	Loss on Ignition MDL 0.1%
2335-001	Reference	02/13/98	351	67.4	9.12
2335-002	6 %	02/13/98	373	67.0	14.0
2335-003	12 %	02/13/98	533	70.0	6.47
2335-004	25 %	02/13/98	329	63.8	9.23
2335-005	50 %	02/13/98	1080	65.1	9.02
2335-006	REM-1	02/13/98	257	70.1	4.76
2335-007	REM-2	02/13/98	384	76.3	4.52
235-008	ACTR	02/13/98	570	66.7	10.5
2335-009	Reference Soil	02/13/98	362	76.4	14.6
2335-010	S-1	02/13/98	19.8	67.1	10.2
2335-011	S-2	02/13/98	169	71.1	11.2
2335-012	S-3	02/13/98	199	58.6	11.8
2335-013	S-4	02/13/98	<15.8*	63.2	9.48
2335-014	S-5	02/13/98	106	63.2	7.41
2335-015	S-TA	02/13/98	30.5	76.3	5.81

* MDL for sample #2335-013; S-4 15.8 mg/kg

MATERIALS AND METHODS / SEDIMENT EXPOSURES - *Hyaella azteca*

Surface sediment samples were collected from the Tennessee Products site in Chattanooga, Tennessee on 13 February, 1998. A series of concentrations (6, 12, 25 and 50%) were created from samples taken at the site to evaluate the possible existence of a toxicity gradient. These sites were selected to represent areas of the Tennessee Products site which may have been impacted by the facility's operations.

Preparation of sediment samples for testing

The sediment samples collected were transported to the laboratory on 17 February, 1998 in glass containers on ice and there were sieved using a #20 mesh sieve (850 μ m) to remove large debris and indigenous species which may have either competed with or potentially preyed upon the test organisms. The sieved portion of the sediment was then transferred to new, clean 1 gallon HDPE containers, sealed and stored at 04° C until used for testing on 20 and 21 February, 1998.

Control sediment used for the test was collected from the Spruce Run Reservoir in Clinton, NJ prior to testing and was stored and sieved in the same manner as the sediment samples from the Tennessee Products site.

Test organisms

Study amphipods (*Hyaella azteca*) were obtained from stock cultures maintained by ABS, Inc. of Fort Collins, CO several days before testing was to begin to allow for a sufficient acclimation to the laboratory reconstituted fresh water which was used as the overlying water for the exposures. During this time, the organisms were held under conditions similar to that which they would encounter during the test (see Table II). Once daily the amphipods were fed a combination of yeast, cereal leaves and digested trout pellets [2]. At the beginning of the 14 day exposure, the test organisms were 10-14 days old.

A reference toxicant test using potassium chloride as the toxicant was conducted concurrently with the 14 day exposure to verify the health of the lot of organisms used in the sediment test. The 48 hr LC₅₀ of 315.5 ppm falls within the acceptable range of a published round robin study conducted by USEPA in 1992 [1]. The mean of the study was 289.0 ppm with confidence limits from 101 to 395 ppm.

Experimental procedures

The entire sediment exposure series for this project consisted of 08 sediment samples from the Tennessee Products site and one of control sediment from Spruce Run Reservoir. Test chambers (300 mL tall form borosilicate glass beakers) were filled with 100 mL of sediment. Each then had the sediment layer covered with 175 mL of laboratory reconstituted fresh water [2]. All of the test chambers were allowed to settle for 24 hours prior to test initiation.

After the settling period, the overlying water was siphoned off and fresh site water was introduced, using a small, round HDPE disk suspended over the sediment to deflect the water flow and minimize disturbance to the sediment. At this time, initial physical chemistries were conducted on the overlying water. Alkalinity, ammonia, conductivity, hardness and pH were measured initially, prior to the introduction of test organisms, and at the end of the 14 day exposure for each sample location and the control. The dissolved oxygen and temperature were also measured initially and every 24 hours thereafter for the duration of the exposure for each sample location and the control.

The exposure period began by placing 10 randomly selected test organisms into each of eight replicate chambers for each sample location and the control. Care was taken to ensure that the organisms were released beneath the surface of the overlying water to keep air bubbles from forcing the organisms to the surface. Each test chamber was then fed 0.5 mL of the YCT mixture previously cited and the test chambers were covered. Test conditions are summarized in Table II.

Each day during the exposure period observations of each chamber were carried out to determine the number of organisms dead, swimming, on the surface of the sediment or on the surface of the water. The overlying water was siphoned off twice a day and replaced using laboratory water as a measure to maintain sufficient dissolved oxygen levels. Care was taken to minimize disturbance of the sediment during water renewal.

At the end of the 14 day exposure the final physical chemistries were performed and the test chambers were prepared for the removal of test organisms. Each chamber was gently stirred using a pipette to suspend the sediment in the water column inside the chamber. This slurry was then poured into a #60 mesh sieve (250 μ m) and rinsed in a shallow pan of laboratory water to remove the finer grains of the sediment. The remaining contents of the sieve were placed into a second shallow pan of laboratory water over a light table. The remaining contents of the sieve were carefully sorted to find the surviving test organisms in each of the eight replicates for each site. All surviving organisms were transferred to a 30 mL soufflé cup for live count verification and preparation for dry weight analysis.

When all test chambers had been sorted and the number of survivors verified, 0.5 mL of ethanol was added to each soufflé cup to dispatch the organisms. They were then transferred to a previously dried and tared aluminum pan and placed into an oven to dry at 105° C for six hours. Upon removal from the oven, the pans were placed into a dessicator to cool and then were measured to the nearest 0.01 mg.

Data analysis

Data analysis was performed following procedures published by the USEPA [1] using the Toxstat data analysis software published by West, Inc., version 3.4. Survival data was transformed by arcsine squareroot and then tested for normality using the Shapiro-Wilk's test or the Chi-Square test and for homogeneity of variance using Bartlett's test as appropriate. Normal data distributions were analyzed using Analysis of Variance followed by Dunnett's comparison of means test. Non-normal data or those data sets exhibiting non-homogeneous variances were analyzed using Steel's Many-one Rank test of Wilcoxon Rank Sum as appropriate.

All raw data sheets are located in Appendix B

TABLE II: Summary of Conditions for *Hyaella azteca* Toxicity Test

1.	Test type;	Whole sediment, static, daily renewal
2.	Temperature;	23.0 +/- 1.0° C
3.	Light quality;	Wide-spectrum fluorescent illumination
4.	Light intensity;	50 - 100 foot-candles
5.	Photoperiod;	16 hours light, 08 hours dark
6.	Test chamber size;	300 mL high form borosilicate glass beakers
7.	Sediment volume;	100 mL / replicate
8.	Overlying water volume;	175 mL
9.	Renewal;	2 volume exchanges per day
10.	Age of test organisms;	10 to 14 days
11.	Number organisms / container;	10
12.	Replicates;	08
13.	Feeding;	Yeast, cereal leaves and trout pellets with <i>Selenastrum capricornutum</i> , 0.5 mL / day
14.	Aeration;	None unless dissolved oxygen concentrations \leq 40 % saturation, then ~ 100 bubbles / min.
15.	Overlying water ;	Laboratory reconstituted fresh water [2]
16.	Test chamber cleaning;	Only if necessary
17.	Overlying water quality;	D. O., pH and temperature daily; alkalinity, ammonia, conductivity and hardness at beginning and end of test
18.	Test duration;	14 days
19.	Effects measured;	Survival and growth (mean dry weight)
20.	Test acceptability;	Minimum control survival 80 %

RESULTS

Effects on Survival

For the first of the two endpoints used, survival, the data was analyzed in two forms. The first analysis, utilized the survival of the test organisms exposed to the laboratory control sediment as the control for analysis (Appendix C). The second analysis utilized the survival of the test organisms exposed to the reference sample collected from the Tennessee Products site as the control, as this may be a more representative interpretation of the data (Appendix D).

In the first analysis the data was transformed via Arc Sine (Square Root (Y)) and analyzed first for normality using the Chi-Square test. The data was found to be non-normal in distribution as there was 100 % mortality in several of the sample exposures. As this data set was not normally distributed, nonparametric analyses were appropriate. Steel's Many-One Rank test was used as the number of replicates per treatment was ≥ 4 and there were equal replicates across all the treatments.

In the second analysis the data was transformed via Arc Sine (Square Root (Y)) and analyzed first for normality using the Chi-Square test. The data was found to be normal in distribution, but the variance was found to be heterogeneous, as one of the groups had zero variance. As this data set was not normally distributed, nonparametric analyses were appropriate. Steel's Many-One Rank test was used to determine statistical significance as the number of replicates per treatment was ≥ 4 and there were equal replicates across all the treatments.

The survival data of the test organisms exposed to samples from all locations, by replicate and by mean survival, are summarized in Table III. Of the 08 sampling locations at the Tennessee Products site, the samples identified as 25%, 50%, ACTR and REM-2 all exhibited 00 % survival and the samples identified as 6%, 12% and REM-1 displayed survivals that were statistically significant from the control treatment, as they exhibited > 20 % mortality. These sites were included in the dry weight analysis for comparison purposes. Only the Reference sample showed no significant statistical difference in survival rate when compared to the control.

Effects on Growth

For the second of the two endpoints used, growth, the data was analyzed in two forms. The first analysis, utilized the growth from the test organisms exposed to laboratory control sediment as the control for analysis (Appendix C). The second analysis utilized the growth of the test organisms exposed to the reference sample collected from the Tennessee Products site as the control, as this may be a more representative interpretation of the data (Appendix D)

In the first analysis the data was analyzed first for normality using the Chi-Square test. The data was found to be normal in distribution. The homogeneity of the variances were then tested using Bartlett's test and found to be homogeneous. As this data set was normally distributed, parametric analyses were appropriate. Dunnett's comparison of means was used to determine any statistical significance.

In the second analysis the data was analyzed first for normality using the Chi-Square test. The data was found to be normal in distribution. The homogeneity of the variances were then tested using Bartlett's test and was not found to be homogeneous. As this data set was heterogeneous, non-parametric analyses were appropriate. Steel's Many-One Rank test was used to determine statistical significance as the number of replicates per treatment was ≥ 4 and there were equal replicates across all the treatments.

Mean dry weight analysis of test organisms exposed to samples identified as 6%, 12% and REM-1 are summarized in Table IV. The average weight of the surviving organisms from these samples were not found to be statistically significant when compared to the Reference site or the control.

Table III Percent survival of *H. azteca* by replicate chamber and mean survival

Rep	Sample Location								
	Con	Ref	6%	12%	25%	50%	ACTR	REM-1	REM-2
A	90	90	60	00	00	00	00	00	00
B	100	80	40	10	00	00	00	10	00
C	90	90	30	00	00	00	00	00	00
D	100	100	50	00	00	00	00	00	00
E	80	80	60	10	00	00	00	00	00
F	80	70	50	30	00	00	00	10	00
G	100	90	40	20	00	00	00	00	00
H	80	80	40	10	00	00	00	10	00
Mean Survival	90	85.0	46.3	10	00	00	00	3.8	00
Statistically Different from Control		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table IV Dry weight (mg) of *H. azteca* by replicate chamber and mean dry weight

Rep	Sample Location				
	Con	Ref	6%	12%	REM-1
A	0.093	0.066	0.070	0.000	0.000
B	0.071	0.055	0.063	0.140	0.070
C	0.026	0.041	0.020	0.000	0.000
D	0.067	0.034	0.032	0.000	0.000
E	0.056	0.020	0.050	0.140	0.000
F	0.048	0.047	0.072	0.070	0.130
G	0.024	0.026	0.025	0.075	0.000
H	0.054	0.040	0.080	0.060	0.050
Mean Dry Wt.	0.055	0.041	0.051	0.061	0.031
Statistically Different from Control		No	No*	No*	No*

* These sample locations were found to have survival rates statistically different from the control

MATERIALS AND METHODS / SEDIMENT EXPOSURES - *Chironomus tentans*

Surface sediment samples were collected from the Tennessee Products site in Chattanooga, Tennessee on 13 February, 1998. A series of concentrations (6, 12, 25 and 50%) were created from samples taken at the site to evaluate the possible existence of a toxicity gradient. These sites were selected to represent areas of the Tennessee Products site which may have been impacted by the facility's operations.

Preparation of sediment samples for testing

The sediment samples collected were transported to the laboratory on 17 February, 1998 in glass containers on ice and there were sieved using a #20 mesh sieve (850 μ m) to remove large debris and indigenous species which may have either competed with or potentially preyed upon the test organisms. The sieved portion of the sediment was then transferred to new, clean 1 gallon HDPE containers, sealed and stored at 04° C until used for testing on 20 and 21 February, 1998.

Control sediment used for the test was collected from the Spruce Run Reservoir in Clinton, NJ prior to testing and was stored and sieved in the same manner as the sediment samples from the Tennessee Products site.

Test organisms

Study chironomids (*Chironomus tentans*) were obtained from stock cultures maintained by ABS, Inc. of Fort Collins, CO several days before testing was to begin to allow for a sufficient acclimation to the laboratory reconstituted fresh water which was used as the overlying water for the exposures. During this time, the organisms were held under conditions similar to that which they would encounter during the test (see Table IV). Once daily the chironomids were fed approximately 4.0 mg of flake fish food [1]. At the beginning of the 14 day exposure, the test organisms were 10-14 days old.

A reference toxicant test using potassium chloride as the toxicant was conducted concurrently with the 14 day exposure to verify the health of the lot of organisms used in the sediment test. The 48 hr LC₅₀ of 770.8 ppm falls within the acceptable range of a published round robin study conducted by USEPA in 1992 [1]. The mean of the study was 4,200 ppm with confidence limits from 560 to 7,500 ppm.

Experimental procedures

The entire sediment exposure series for this project consisted of 08 sediment samples from the Tennessee Products site and one of control sediment from Spruce Run Reservoir. Test chambers (300 mL tall form borosilicate glass beakers) were filled with 100 mL of sediment. Each then had the sediment layer covered with 175 mL of laboratory reconstituted fresh water [2]. All of the test chambers were allowed to settle for 24 hours prior to test initiation.

After the settling period, the overlying water was siphoned off and fresh site water was introduced, using a small, round HDPE disk suspended over the sediment to deflect the water flow and minimize disturbance to the sediment. At this time, initial physical chemistries were conducted on the overlying water. Alkalinity, ammonia, conductivity, hardness and pH were measured initially, prior to the introduction of test organisms, and at the end of the 14 day exposure for each sample location and the control. The dissolved oxygen, pH and temperature were also measured initially and every 24 hours thereafter for the duration of the exposure for each sample location and the control.

The exposure period began by placing 10 randomly selected test organisms into each of eight replicate chambers for each sample location and the control. Care was taken to ensure that the organisms were released beneath the surface of the overlying water to keep air bubbles from forcing the organisms to the surface. Each test chamber was then fed 4.0 mg of flake food and the test chambers were covered. Test conditions are summarized in Table IV.

Each day during the exposure period observations of each chamber were carried out to determine the number of organisms dead, on the surface of the sediment or on the surface of the water. The overlying water was siphoned off twice a day and replaced using laboratory water as a measure to maintain sufficient dissolved oxygen levels. Care was taken to minimize disturbance of the sediment during water renewal.

At the end of the 14 day exposure the final physical chemistries were performed and the test chambers were prepared for the removal of test organisms. Each chamber was gently stirred using a pipette to suspend the sediment in the water column inside the chamber. This slurry was then poured into a #60 mesh sieve (250 μ m) and rinsed in a shallow pan of laboratory water to remove the finer grains of the sediment. The remaining contents of the sieve were placed into a second shallow pan of laboratory water over a light table. The remaining contents of the sieve were carefully sorted to find the surviving test organisms in each of the eight replicates for each site. All surviving larvae were transferred to a 30 mL soufflé cup for live count verification and preparation for dry weight analysis. Pupae were counted for survival purposes, but were not included in the weight analysis.

When all test chambers had been sorted and the number of survivors verified, 0.5 mL of ethanol was added to each soufflé cup to dispatch the organisms. They were then transferred to a previously dried and tared aluminum pan and placed into an oven to dry at 105° C for six hours. Upon removal from the oven, the pans were placed into a dessicator to cool and then were measured to the nearest 0.01 mg.

Data analysis

Data analysis was performed following procedures published by the USEPA[1] using the Toxstat data analysis software published by West, Inc., version 3.4. Survival data was transformed by arcsine squareroot and then tested for normality using the Shapiro-Wilk's test or the Chi-Square test and for homogeneity of variance using Bartlett's test as appropriate. Normal data distributions were analyzed using Analysis of Variance followed by Dunnett's comparison of means test. Non-normal data or those data sets exhibiting non-homogeneous variances were analyzed using Steel's Many-one Rank test or Wilcoxon Rank Sum as appropriate.

All raw data sheets are located in Appendix E.

TABLE IV: Summary of Conditions for *Chironomus tentans* Toxicity Test

1.	Test type;	Whole sediment, static, daily renewal
2.	Temperature;	23.0 +/- 1.0° C
3.	Light quality;	Wide-spectrum fluorescent illumination
4.	Light intensity;	50 - 100 foot-candles
5.	Photoperiod;	16 hours light, 08 hours dark
6.	Test chamber size;	300 mL high form borosilicate glass beakers
7.	Sediment volume;	100 mL / replicate
8.	Overlying water volume;	175 mL
9.	Renewal;	2 volume exchanges per day
10.	Age of test organisms;	Third instar larvae(All organisms must be third instar or younger with at least 50% at third instar)
11.	Number organisms / container;	10
12.	Replicates;	08
13.	Feeding;	4.0 mg flake fish food / day
14.	Aeration;	None unless dissolved oxygen concentrations ≤ 40 % saturation, then ~ 100 bubbles / min.
15.	Overlying water ;	Laboratory reconstituted fresh water [2]
16.	Test chamber cleaning;	Only if necessary
17.	Overlying water quality;	D. O., pH and temperature daily; alkalinity, ammonia, conductivity and hardness at beginning and end of test
18.	Test duration;	14 days
19.	Effects measured;	Survival and growth (mean dry weight)
20.	Test acceptability;	Minimum control survival 80 %

RESULTS

Effects on Survival

For the first of the two endpoints used, survival, the data was analyzed in two forms. The first analysis, utilized the survival of the test organisms exposed to the laboratory control sediment as the control for analysis (Appendix F). The second analysis utilized the survival of the test organisms exposed to the reference sample collected from the Tennessee Products site as the control, as this may be a more representative interpretation of the data (Appendix G).

In the first analysis the data was transformed via Arc Sine (Square Root (Y)) and analyzed first for normality using the Chi-Square test. The data was found to be normal in distribution, but the variance was found to be heterogeneous, as one of the groups had zero variance. As this data set was not normally distributed, nonparametric analyses were appropriate. Steel's Many-One Rank test was used as the number of replicates per treatment was > 4 and there were equal replicates across all the treatments.

In the second analysis the data was transformed via Arc Sine (Square Root (Y)) and analyzed first for normality using the Chi-Square test. The data was found to be normal in distribution, but the variance was found to be heterogeneous, as one of the groups had zero variance. As this data set was not normally distributed, nonparametric analyses were appropriate. Steel's Many-One Rank test was used as the number of replicates per treatment was > 4 and there were equal replicates across all the treatments.

The survival data of the test organisms exposed to samples from all locations, by replicate and by mean survival, are summarized in Table VI. Of the 08 sampling locations at the Tennessee Products site, the samples identified as ACTR exhibited 00 % survival and the samples identified as 12%, 25%, 50% and REM-2 displayed survivals that were statistically significant from the control treatment, as they exhibited > 20 % mortality. These sites were included in the dry weight analysis for comparison purposes. The Reference sample, along with the samples identified as 6% and REM-1 showed no significant statistical difference in survival rate when compared to the control.

Effects on Growth

For the second of the two endpoints used, growth, the data was analyzed in two forms. The first analysis, utilized the growth from the test organisms exposed to laboratory control sediment as the control for analysis (Appendix F). The second analysis utilized the growth of the test organisms exposed to the reference sample collected from the Tennessee Products site as the control, as this may be a more representative interpretation of the data (Appendix G)

In the first analysis the data was analyzed first for normality using the Chi-Square test. The data was found to be normal in distribution. The homogeneity of the variances were then tested using Bartlett's test and found to be heterogeneous. As this data set exhibited non-homogeneous variances, Steel's Many-One Rank test was used as the number of replicates per treatment was > 4 and there were equal replicates across all the treatments.

In the second analysis the data was analyzed first for normality using the Chi-Square test. The data was found to be normal in distribution. The homogeneity of the variances were then tested using Bartlett's test and found to be heterogeneous. As this data set exhibited non-homogeneous variances, Steel's Many-One Rank test was used as the number of replicates per treatment was > 4 and there were equal replicates across all the treatments.

Mean dry weight analysis of test organisms exposed to samples identified as 6%, 12%, 25%, 50%, REM-1 and REM-2 are summarized in Table VII. The average weight of the surviving organisms from samples 6%, 12%, REM-1 and REM-2 were not found to be statistically significant when compared to the Reference site or the control. The average weight of the surviving organisms from samples 25% and 50% were found to be statistically significant when compared to the Reference site or the control

All statistical analysis is located in Appendix G.

Table VI Percent survival of *C. tentans* by replicate chamber and mean survival

Rep	Sample Location								
	Con	Ref	6%	12%	25%	50%	ACTR	REM-1	REM-2
A	100	70	70	80	00	00	00	70	20
B	80	80	70	50	20	30	00	100	20
C	90	80	80	40	00	00	00	80	20
D	80	90	90	70	10	00	00	80	30
E	100	70	90	50	10	00	00	70	20
F	80	90	70	60	00	00	00	90	10
G	80	80	70	70	10	00	00	70	10
H	90	90	80	70	10	10	00	80	00
Mean Survival	87.5	81.3	77.5	61.3	7.5	5.0	00	80.0	16.3
Statistically Different from Control		No	No	Yes	Yes	Yes	Yes	No	Yes

Table VII Dry weight (mg) of *C. tentans* by replicate chamber and mean dry weight

Rep	Sample Location							
	Con	Ref	6%	12%	25%	50%	REM-1	REM-2
A	0.946	0.942	1.026	0.983	1.935	0.380	0.757	0.710
B	1.175	0.715	0.899	1.060	0.660	0.800	1.101	1.005
C	0.950	1.089	0.743	1.090	0.290	0.000	0.943	1.210
D	1.381	1.128	0.701	1.081	0.230	0.000	0.906	0.670
E	1.092	1.466	0.911	1.276	0.580	0.000	1.040	0.450
F	0.936	1.058	1.033	1.290	0.000	0.000	1.032	1.890
G	1.327	1.151	0.924	0.896	0.000	0.000	1.246	1.010
H	0.931	0.840	1.249	1.243	0.000	0.000	0.866	0.000
Mean Dry Wt.	1.092	1.049	0.936	1.115	0.462	0.148	0.986	0.868
Statistically Different from Control		No	No	No*	Yes	Yes	No	No*

* These sample locations were found to have survival rates statistically different from the control

REFERENCES

- [1] **Ingersoll, C.G.** 1994 Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates EPA 600/R-94/024. U.S. Environmental Protection Agency, Washington, DC.
- [2] **Weber, C.I.** 1993 Short-Term Methods For Estimating The Chronic Toxicity of Effluents and Receiving Water To Freshwater Organisms EPA/600/4-90/027F. U.S. Environmental Protection Agency, Washington, DC.

APPENDIX A
RAW DATA FOR OIL & GREASE
(SW-846-9071)
AND LOSS ON IGNITION
(AASHTO T 267-86)



March 15, 1998

TO: AMERICAN PRODUCTS, INC., TEL.
1111 UNION BLVD., 2ND FL. EAST
PITTSBURGH, PA 15106
412-9015 FAX 412-2510
CHRIS NALLY

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB79795	Client's Code: AMERHQUA
Purchase order number: 118M55E	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	S-1A
Sample collector: T.P.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: KM	Validated by: SLS

Parameter: Grease & Oil (Dry Weight)

Method reference: 9071H

Result: 50.5 mg/kg

MDL or sensitivity: 10.0

Date started: 03/03/98

Date finished: 03/04/98

Time started: 12:00

Analyst: SB

Parameter: % Solids

Method reference: 1001.3

Result: 76.5 %

MDL or sensitivity: 0.001

Date started: 03/23/98

Date finished: 03/24/98

Time started: 12:00

Analyst: AD

Parameter: Loss On Ignition

Method reference: 1 267-86

Result: 5.81 %

MDL or sensitivity: 0.1

Date started: 03/23/98

Date finished: 03/24/98

Time started: 12:00

Analyst: AD

Sample comments:

SAMPLE #2335-W15 LOCATION: S-1A

SITE: TENNESSEE PRODUCTS PERM. NO#: 03347-142 001: 2335-01

004#: 2335 EPA CONTRACT# 68-L4-0022



AMERICAN AQUATIC TESTING, INC. Sample I.D. AB79795 (continued)
Page: 2
March 13, 1998

If there are any questions regarding this data, please call.

Released By



March 13, 1998

To: AMERICAN AQUATIC TESTING, INC.
1111 UNION BLVD., 2ND FL. EAST
ALLENTOWN PA 18103
434-9015 FAX 434-2510
CHRIS NALLY

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB/9788	Client's Code: AMERAAQUA
Purchase order number: TENNESSE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	25%
Sample collector: L.P.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: KM	Validated by: SLS

Parameter: Grease & Oil (Dry Weight)
Method reference: 9071A
Result: 329 mg/kg
Date started: 03/03/98
Time started: 12:00

MDL or sensitivity: 10.0
Date finished: 03/04/98
Analyst: SS

Parameter: % Solids
Method reference: 160.3
Result: 63.8 %
Date started: 02/19/98
Time started: 15:15

MDL or sensitivity: 0.01
Date finished: 02/20/98
Analyst: AD

Parameter: Loss On Ignition
Method reference: T 267-86
Result: 9.23 %
Date started: 02/19/98
Time started: 13:15

MDL or sensitivity: 0.1
Date finished: 02/20/98
Analyst: AD

Sample comments:

SAMPLE #2335-004 LOCATION: 25%
SITE: TENNESSEE PRODUCTS REFID WU#: 03347-142-W01-2335-01
WA#: 2335 EPA CONTRACT# 68-L4-0022



AMERICAN AQUATIC TESTING, INC. Sample I.D. AB79788 (continued)
Page: 2
March 13, 1998

If there are any questions regarding this data, please call.

Released By



MARCH 13, 1998

TO: AMERICAN PROTECTIVE TESTING, INC.
3101 UNION DEPOSIT, AND E. EAST
ALLENTOWN PA 18103
610-494-1515 FAX 610-494-2510
CIRCUIT BOARD

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB79794	Client's Code: AMERAGUA
Purchase order number: TENNESSEE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	S-5
Sample collector: L.P.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:00
Received by: KM	Validated by: SLS

Parameter: Insect & Oil (Dry Weight)

Method reference: 9071A

Result: 105 mg/kg

Date started: 03/03/98

Time started: 12:00

MDL or sensitivity: 10.0

Date finished: 03/04/98

Analyst: SS

Parameter: % Solids

Method reference: 1001.3

Result: 0.5 %

Date started: 03/03/98

Time started: 12:00

MDL or sensitivity: 0.100

Date finished: 03/04/98

Analyst: AD

Parameter: Loss on Ignition

Method reference: 1007.00

Result: 71.41 %

Date started: 03/03/98

Time started: 12:00

MDL or sensitivity: 0.1

Date finished: 03/04/98

Analyst: AD

Sample comments:

SAMPLE #2335-014 LOCATION: S-5

DATE: TENNESSEE PRODUCTS REAC WOH: 03347-142-001-2335-01

WIR: 2335 EPA CONTRACT# 68-L4-0022



**WASTEX
INDUSTRIES, INC.**

28 S. Hanover Street
Pottstown, PA 19464
610/327-0880



APPROVED FOR RELEASE BY: [illegible] SAMPLE NO. 100-3773-1000000000
PAGE 1
March 12, 1990

If there are any questions regarding this data, please call.

Released By



March 13, 1998

TO: AMERICAN INDUSTRIAL TESTING, INC.
111 UNION DEPOSIT RD. EAST
MILFORD PA 18301
610-901-1111 FAX 610-901-1112
EJES:MLC

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB79793	Client's Code: AMERAGUA
Purchase order number: TENNESSEE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	S-4
Sample collector: J.P.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: RM	Validated by: SLS

Parameter: Grease & Oil (Dry Weight)

Method reference: 90710

Result: 15.8

Date started: 03/03/98

Time started: 12:00

Unit: mg/kg

MDL or sensitivity: 15.8

Date finished: 03/04/98

Analyst: SA

Parameter: % Solids

Method reference: 90610

Result: 0.2 %

Date started: 02/23/98

Time started: 12:00

MDL or sensitivity: 0.1

Date finished: 02/24/98

Analyst: RU

Parameter: Loss On Ignition

Method reference: 90510

Result: 9.48 %

Date started: 02/23/98

Time started: 12:00

MDL or sensitivity: 0.1

Date finished: 02/24/98

Analyst: RU

Sample comments:

SAMPLE #2335-013 LOCATION: S-4

SITE: TENNESSEE PRODUCTS RECD WD#: 03347-142-WD# 2335-01

WH#: 2335 EPA CONTRACT# 68-D4-0022



WASTEX
INDUSTRIES, INC.

28 S. Hanover Street
Pottstown, PA 19464
610/327-0880



AMERICAN HEATHING TESTING, INC. Sample I.D. HB/9793 (Continued)
Page: 2
March 13, 1998

If there are any questions regarding this data, please call.

Released By



March 13, 1998

To: AMERICAN AQUATIC TESTING, INC.
1111 UNION BLVD., 2ND FL. EAST
ALLENTOWN PA 18103
434-9015 FAX 434-2510
CHRIS NALLY

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB79792	Client's Code: AMERAQUA
Purchase order number: TENNESSE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	S-3
Sample collector: J.P.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: KM	Validated by: SLS

Parameter: Grease & Oil (Dry Weight)

Method reference: 90710

Result: 199 mg/kg

Date started: 03/03/98

Time started: 12:00

MDL or sensitivity: 10.0

Date finished: 03/04/98

Analyst: SS

Parameter: % Solids

Method reference: 1601.3

Result: 58.6 %

Date started: 02/23/98

Time started: 12:00

MDL or sensitivity: 0.01

Date finished: 02/24/98

Analyst: AD

Parameter: Loss On Ignition

Method reference: T 267-86

Result: 11.8 %

Date started: 02/23/98

Time started: 12:00

MDL or sensitivity: 0.1

Date finished: 02/24/98

Analyst: AD

Sample comments:

SAMPLE #2335-012 LOCATION: S-3

SITE: TENNESSEE PRODUCTS READ WO#: 03347-142-001-2335-01

WA#: 2335 EPA CONTRACT# 68-L4-0022



AMERICAN AQUATIC TESTING, INC. Sample I.D. AB79792 (continued)
Page: 2
March 13, 1998

If there are any questions regarding this data, please call.

Released By



March 13, 1998

To: AMERICAN AQUATIC TESTING, INC.
1111 UNION BLVD., 2ND FL. EAST
ALLENTOWN PA 18103
434-9015 FAX 434-2510
CHRIS NALLY

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB79791	Client's Code: AMERAQUA
Purchase order number: TENNESSE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	S-2
Sample collector: J.P.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: KM	Validated by: SLS

Parameter: Grease & Oil (Dry Weight)
Method reference: 9071A
Result: 169 mg/kg
Date started: 03/03/98
Time started: 12:00

MDL or sensitivity: 10.0
Date finished: 03/04/98
Analyst: SS

Parameter: % Solids
Method reference: 160.3
Result: 71.1 %
Date started: 02/19/98
Time started: 15:15

MDL or sensitivity: 0.01
Date finished: 02/20/98
Analyst: AD

Parameter: Loss On Ignition
Method reference: T 267-86
Result: 11.2 %
Date started: 02/19/98
Time started: 15:15

MDL or sensitivity: 0.1
Date finished: 02/20/98
Analyst: AD

Sample comments:

SAMPLE #2335-011 LOCATION: S-2
SITE: TENNESSEE PRODUCTS REAC WO#: 03347-142-001-2335-01
WA#: 2335 EPA CONTROL# 68-C4-0022



AMERICAN AQUATIC TESTING, INC. Sample I.D. AB79791 (continued)

Page: 2

March 13, 1998

If there are any questions regarding this data, please call.

Released By



March 13, 1998

To: AMERICAN AQUATIC TESTING, INC.
1111 UNION BLVD., 2ND FL. EAST
ALLENTOWN PA 18103
434-9015 FAX 434-2510
CHRIS NALLY

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB79790	Client's Code: AMERAQUA
Purchase order number: TENNESSE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	S-1
Sample collector: L.P.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: RM	Validated by: SLB

Parameter: Grease & Oil (Dry Weight)

Method reference: 9071A

Result: 19.8 mg/kg

Date started: 03/03/98

Time started: 12:00

MDL or sensitivity: 10.0

Date finished: 03/04/98

Analyst: SB

Parameter: % Solids

Method reference: 100.3

Result: 67.1 %

Date started: 02/19/98

Time started: 15:15

MDL or sensitivity: 0.01

Date finished: 02/20/98

Analyst: AD

Parameter: Loss On Ignition

Method reference: T 267-86

Result: 10.2 %

Date started: 02/19/98

Time started: 15:15

MDL or sensitivity: 0.1

Date finished: 02/20/98

Analyst: AD

Sample comments:

SAMPLE #2335-010 LOCATION: S-1

SITE: TENNESSEE PRODUCTS REAC WU#: 03347-142-001-2335-01

WU#: 2335 EPA CONTRACT# 68-C4-0022



AMERICAN AQUATIC TESTING, INC. Sample I.D. AB79790 (continued)

Page: 2

March 13, 1998

If there are any questions regarding this data, please call.

Released By



MARCH 13, 1998

TO: AMERICAN ABUTMENT TESTING, INC.
1111 UNION BLVD., 2ND FL. EAST
ALLENTOWN PA 18103
434-9015 FAX 434-2310
CHRIS NALLY

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB79796	Client's Code: AMERAQUA
Purchase order number: TENNESSEE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	REF. SOIL
Sample collector: L.P.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: KM	Validated by: SLS

Parameter: Grease & Oil (Dry Weight)

Method reference: 9071A

Result: 362 mg/kg

Date started: 03/03/98

Time started: 12:00

MDL or sensitivity: 10.0

Date finished: 03/04/98

Analyst: SS

Parameter: % Solids

Method reference: 100.3

Result: 76.4 %

Date started: 02/24/98

Time started: 12:00

MDL or sensitivity: 0.01

Date finished: 02/24/98

Analyst: AD

Parameter: Loss On Ignition

Method reference: 1 267-86

Result: 14.6 %

Date started: 02/23/98

Time started: 12:00

MDL or sensitivity: 0.1

Date finished: 02/24/98

Analyst: AD

Sample comments:

SAMPLE #2335-009 LOCATION: REFERENCE SOIL
SITE: TENNESSEE PRODUCTS REAC W0#: 03347-142-001-2335-01
WA#: 2335 EPA CONTRACT# 68-C4-0022



28 S. Hanover Street
Pottstown, PA 19464
610/327-0880



AMERICAN AQUATIC TESTING, INC. Sample I.D. AB79796 (continued)
Page: 2
March 13, 1998

If there are any questions regarding this data, please call.

A handwritten signature in black ink, appearing to be 'Tim [unclear]', written over a horizontal line.

Released By



March 13, 1998

To: AMERICAN AQUATIC TESTING, INC.
1111 UNION BLVD., 2ND FL. EAST
ALLENTOWN PA 18103
434-9015 FAX 434-2510
CHRIS NALLY

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB/9/84	Client's Code: AMERH20H
Purchase order number: TENNESSEE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	HLR
Sample collector: L.P.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: KM	Validated by: SLS

Parameter: Grease & Oil (Dry Weight)

Method reference: 9071A

Result: 570 mg/kg

Date started: 03/03/98

Time started: 12:00

MDL or sensitivity: 10.0

Date finished: 03/04/98

Analyst: SS

Parameter: % Solids

Method reference: 1601.3

Result: 66.7 %

Date started: 02/19/98

Time started: 10:15

MDL or sensitivity: 0.01

Date finished: 02/20/98

Analyst: AD

Parameter: Loss On Ignition

Method reference: 1 267-86

Result: 10.5 %

Date started: 02/19/98

Time started: 10:15

MDL or sensitivity: 0.1

Date finished: 02/20/98

Analyst: AD

Sample comments:

SAMPLE #2335-0008 LOCATION:HLR

SITE:TENNESSEE PRODUCTS RECD NO#: 03347-142-001-2335-01

QA#: 2335 EPA CONTRACT# 68-L4-0022



AMERICAN AQUATIC TESTING, INC. Sample I.D. AB79784 (continued)

Page: 2

March 13, 1998

If there are any questions regarding this data, please call.

Released By



March 13, 1998

To: AMERICAN AQUATIC TESTING, INC.
1111 UNION BLVD., 2ND FL. EAST
ALLENTOWN PA 18106
434-9015 FAX 434-2510
CHRIS NALLY

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB79783	Client's Code: AMICKH004
Purchase order number: TENNESSEE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	REM-2
Sample collector: L.P.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: KM	Validated by: SLS

Parameter: Grease & Oil (Dry Weight)

Method reference: 90/1A

Result: 384 mg/kg

Date started: 03/03/98

Time started: 12:00

MDL or sensitivity: 10.0

Date finished: 03/04/98

Analyst: SB

Parameter: % Solids

Method reference: 160.3

Result: 76.3 %

Date started: 02/19/98

Time started: 15:15

MDL or sensitivity: 0.01

Date finished: 02/20/98

Analyst: AD

Parameter: Loss On Ignition

Method reference: 1 267-86

Result: 4.52 %

Date started: 02/19/98

Time started: 15:15

MDL or sensitivity: 0.1

Date finished: 02/20/98

Analyst: AD

Sample Comments:

SAMPLE #2335-007 LOCATION: REM-2

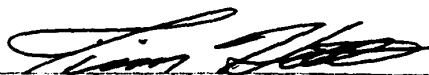
SITE: TENNESSEE PRODUCTS REM-2 WO#: 03347-142-001-2335-01

WA#: 2335 EPA CONTRACT# 68-C4-0022



AMERICAN AQUATIC TESTING, INC. Sample I.D. AB79783 (continued)
Page: 2
March 13, 1998

If there are any questions regarding this data, please call.



Released By



March 13, 1998

TO: VEE RICHARDSON, JR., JR., JR.
1111 UNION BLVD., SUITE 100
ALLIANCE FOR THE ENVIRONMENT
934-9015 FAX: 434-8100
CHURCH HILL

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB79782	Client's Code: AMERAGUA
Purchase order number: TENNESSEE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	REM 1
Sample collector: L.F.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: KM	Validated by: SLS

Parameter: Grease & Oil (Dry Weight)

Method reference: 9071A

Result: 257 mg/kg

MDL or sensitivity: 10.0

Date started: 03/03/98

Date finished: 03/04/98

Time started: 12:00

Analyst: SB

Parameter: A Solids

Method reference: 100.1

Result: 70.1 %

MDL or sensitivity: 0.01

Date started: 02/13/98

Date finished: 02/20/98

Time started: 11:10

Analyst: AD

Parameter: Loss on Ignition

Method reference: 1 867-86

Result: 4.76 %

MDL or sensitivity: 0.1

Date started: 02/19/98

Date finished: 02/20/98

Time started: 15:15

Analyst: AD

Sample comments:

SAMPLE #2335-006 LOCATION: REM-1

SITE: TENNESSEE PRODUCTS REAC WD#: 03347-142-001-2335-01

WA#: 2335 EPA CONTRACT# 68-C4-0022



WASTEX
INDUSTRIES, INC.

28 S. Hanover Street
Pottstown, PA 19464
610/327-0880



AMERICAN AQUATIC TESTING, INC. Sample I.D. AB79782 (continued)

Page: 2

March 13, 1998

If there are any questions regarding this data, please call.

Released By



March 13, 1998

To: AMERICAN AQUATIC TESTING, INC.
1111 UNION BLVD., 2ND FL. EAST
ALLEN TOWN PA 18103
434-9015 FAX 434-2510
CHRIS NALLY

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB/9789	Client's Code: AMERAQUA
Purchase order number: TENNESSE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	MDL
Sample collector: L.P.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: KM	Validated by: SLS

Parameter: Grease & Oil (Dry Weight)

Method reference: 9071A

Result: 1080 mg/kg

Date started: 03/03/98

Time started: 12:00

MDL or sensitivity: 10.0

Date finished: 03/04/98

Analyst: SS

Parameter: % Solids

Method reference: 160.3

Result: 65.1 %

Date started: 02/19/98

Time started: 15:15

MDL or sensitivity: 0.01

Date finished: 02/20/98

Analyst: AD

Parameter: Loss On Ignition

Method reference: T 267-86

Result: 9.02 %

Date started: 02/19/98

Time started: 15:15

MDL or sensitivity: 0.1

Date finished: 02/20/98

Analyst: AD

Sample comments:

SAMPLE #2335-005 LOCATION: 50%

SITE: TENNESSEE PRODUCTS REHL. WU#: 03347-142-W01-2335-01

WU#: 2335 EPA CONTRACT# 68-04-0002



28 S. Hanover Street
Pottstown, PA 19464
610/327-0880



AMERICAN AQUATIC TESTING, INC. Sample I.D. AB79789 (continued)

Page: 2

March 13, 1998

If there are any questions regarding this data, please call.

A handwritten signature in black ink, appearing to be 'Tim Allen', written over a horizontal line.

Released By



March 13, 1998

To: AMERICAN AQUATIC TESTING, INC.
1111 UNION BLVD., 2ND FL. EAST
ALLENTOWN PA 18103
434-9015 FAX 434-2510
CHRIS NALLY

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB/9/8/	Client's Code: AMERAAQUA
Purchase order number: TENNESSEE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	12%
Sample collector: L.P.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: KM	Validated by: SLS

Parameter: Grease & Oil (Dry Weight)

Method reference: 90/1A

Result: 533 mg/kg

Date started: 03/03/98

Time started: 12:00

MDL or sensitivity: 10.0

Date finished: 03/04/98

Analyst: SS

Parameter: % Solids

Method reference: 160.3

Result: 70.0 %

Date started: 02/19/98

Time started: 15:15

MDL or sensitivity: 0.01

Date finished: 02/20/98

Analyst: AD

Parameter: Loss On Ignition

Method reference: 1 267-B6

Result: 6.47 %

Date started: 02/19/98

Time started: 15:15

MDL or sensitivity: 0.1

Date finished: 02/20/98

Analyst: AD

Sample comments:

SAMPLE #2335-003 LOCATION: 12%

SITE: TENNESSEE PRODUCTS REAG WO#: 03347-142-001-2335-01

WA#: 2335 EPA CONTRACT# AB-L4-002c



WASTEX
INDUSTRIES, INC.

AMERICAN AQUATIC TESTING, INC.

Page: c

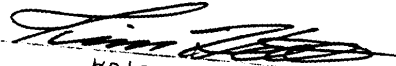
March 13, 1998

28 S. Hanover Street
Pottstown, PA 19464
610/327-0880



Sample I.D. AB79787 (continued)

If there are any questions regarding this data, please call.



Released By

NI DEP 77371

Certified Analytical Laboratories

PA DER 46-005



March 13, 1998

To: AMERICAN AQUATIC TESTING, INC.
1111 UNION BLVD., 2ND FL. EAST
ALLENTOWN PA 18103
434-9015 FAX 434-2510
CHRIS NALLY

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB79786	Client's Code: AMERHQUA
Purchase order number: TENNESSE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	6%
Sample collector: T.E.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: KM	Validated by: SLS

Parameter: Grease & Oil (Dry Weight)

Method reference: 9071A

Result: 373 mg/kg

Date started: 03/03/98

Time started: 12:00

MDL or sensitivity: 10.0

Date finished: 03/04/98

Analyst: SS

Parameter: % Solids

Method reference: 160.3

Result: 67.0 %

Date started: 02/19/98

Time started: 15:15

MDL or sensitivity: 0.01

Date finished: 02/20/98

Analyst: AD

Parameter: Loss on Ignition

Method reference: 1 267-86

Result: 14.0 %

Date started: 02/19/98

Time started: 15:15

MDL or sensitivity: 0.1

Date finished: 02/20/98

Analyst: AD

Sample comments:

SAMPLE #2335-002 LOCATION: 6%

SITE: TENNESSEE PRODUCTS REAC WD#: 03347-142-001-2335-01

WA#: 2335 EPA CONTRACT# 68-C4-0022



28 S. Hanover Street
Pottstown, PA 19464
610/327-0880



AMERICAN AQUATIC TESTING, INC. Sample I.D. AB/9/86 (continued)
Page: 2
March 13, 1998

If there are any questions regarding this data, please call.

A handwritten signature in black ink, appearing to be 'Timothy', written over a horizontal line.

Released By



MARCH 13, 1998

TO: AMERICAN AGRICULTURAL TESTING, INC.
1111 UNION BLVD., 2ND FL. EAST
ALLENTOWN PA 18103
434-9015 FAX 434-2510
CHRIS NALLY

The following analytical results have been obtained for the indicated sample which was submitted to this laboratory:

Sample I.D. AB/9785	Client's Code: AMERAGUAH
Purchase order number: TENNESSE	Sampling date: 02/13
Client's Description: TENNESSEE PRODUCTS	REFERENCE
Sample collector: L.F.	Sample collection date: 02/13/98
Lab submittal date: 02/19/98	Time: 12:30
Received by: KPI	Validated by: SLS

Parameter: Grease & Oil (Dry Weight)

Method reference: 9071A

Result: 351 mg/kg

MDL or sensitivity: 10.0

Date started: 03/03/98

Date finished: 03/04/98

Time started: 12:00

Analyst: SS

Parameter: % Solids

Method reference: 160.3

Result: 67.4 %

MDL or sensitivity: 0.01

Date started: 02/19/98

Date finished: 02/20/98

Time started: 15:15

Analyst: AD

Parameter: Loss On Ignition

Method reference: 1 267-86

Result: 9.12 %

MDL or sensitivity: 0.1

Date started: 02/19/98

Date finished: 02/20/98

Time started: 15:15

Analyst: AD

Sample comments:

SAMPLE #2335-001 LOCATION:REFERENCE

SITE:TENNESSEE PRODUCTS REHL WU#: 0334/-142-001-2335-01

WA#: 2335 EPA CONTRACT# 68-C4-0022



AMERICAN AQUATIC TESTING, INC. Sample I.D. AB79785 (continued)
Page: 2
March 13, 1998

If there are any questions regarding this data, please call.

released by



SHIP TO:
Wastex Industries, Inc.
28 South Hanover Street
Pottstown, PA 19464
(610) 327-0880
FAX 327-9608
Attn.

TOTAL ANALYTICAL SERVICES FOR A SAFE ENVIRONMENT

WASTEX INDUSTRIES, INC.

REPORT TO:
Client Name American Aquatic Testing, Inc.
Address 1111 Union Blvd. 2nd Floor East
Phone (610) 434-9015 FAX (610) 434-2510
Attn. Chris Nally

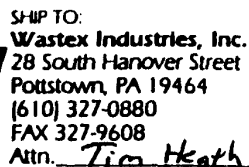
CHAIN OF CUSTODY RECORD

WASTEX DOES NOT ACCEPT LIABILITY FOR SAMPLES WHICH ARE DAMAGED OR LOST WHILE IN THE POSSESSION OF INDEPENDENT COURIERS

TURNAROUND (INDICATE WORKING DAYS. CONFIRM WITH LAB): 1 2 3 5 10 OTHER.
DELIVERABLES (PLEASE CIRCLE): TIER I TIER II/ECRA BUST RESULTS ONLY OTHER:

PROJECT NO.		PROJECT NAME		CLIENT NAME		PROJECT MGR (PHONE NO.)		ANALYSIS												REMARKS	
		AB79782-794																			
SAMPLE ID NO	DATE	TIME	COMP	GRAB	SAMPLE LOCATION	NUMBER OF CONTAINERS	GC/MS BASE NEUTRAL/ACID	GC/MS VOLATILES	TCLP METALS-ORGANICS	PESTICIDES + HERBICIDES	TOC/TOT/DOC/COD	PH - CORROSIVITY	FLASHPOINT - IGNITABILITY	CHEM REACTIVITY	METALS	PCBS	PETROLEUM HYDROCARBONS	TSSTOXTS	oil/Grease	ADDITIONAL REQUIREMENTS	
	2/13			X	REM-1	2									X				X		
	2/13			X	REM-2	2									X				X		
	2/13			X	ACTR	2									X				X		
	2/13			X	Reference	2									X				X		
	2/13			X	6%	2									X				X		
	2/13			X	12%	2									X				X		
	2/13			X	25%	2									X				X		
	2/13			X	50%	2									X				X		
	2/13			X	S-1	2									X				X		
	2/13			X	S-2	2									X				X		
	2/13			X	S-3	2									X				X		
	2/13			X	S-4	2									X				X		
	2/13			X	S-5	2									X				X		
SHIPPED VIA:							TOTAL		HCL		NACH		HNO ₃		HCL		H ₂ SO ₄		CIRCLE IF SAMPLE IS PRESERVED		
RELINQUISHED BY (SIGNATURE) <u>Tarmo Pallap</u>			DATE/TIME <u>2/19/98 11:15</u>			RECEIVED BY (SIGNATURE) <u>Jim Heath</u>			DATE/TIME <u>2/19/98 11:15</u>			REMARKS									
PRINTED NAME <u>TARMO PALLAP</u>						PRINTED NAME <u>Jim Heath</u>															
RELINQUISHED BY (SIGNATURE)			DATE/TIME			RECEIVED BY (SIGNATURE)			DATE/TIME												
PRINTED NAME						PRINTED NAME															
RELINQUISHED BY (SIGNATURE) <u>Jim Heath</u>			DATE/TIME <u>2/19/98 12:30</u>			RECEIVED FOR LABORATORY BY (SIGNATURE) <u>Kenneth A. Mock</u>			DATE/TIME <u>2/19/98 12:30</u>												
PRINTED NAME <u>Jim Heath</u>						PRINTED NAME <u>Kenneth A. Mock</u>															
SAMPLER (SIGNATURE)						SAMPLER'S NAME (PRINT)															

Client Retains Pink Copy Only



TOTAL ANALYTICAL SERVICES FOR A SAFE ENVIRONMENT

WASTEX INDUSTRIES, INC.

REPORT TO: _____ Page _____ of _____
Client Name American Aquatic Testing, Inc.
Address 1111 Union Blvd. 2nd Floor - East
Phone (610) 434-9015 FAX (610) 434-3510
Attn: Chris Mally

CHAIN OF CUSTODY RECORD

WASTEX DOES NOT ACCEPT LIABILITY FOR SAMPLES WHICH ARE DAMAGED OR LOST WHILE IN THE POSSESSION OF INDEPENDENT COURIERS

TURNAROUND (INDICATE WORKING DAYS, CONFIRM WITH LAB):				1	2	3	5	10	OTHER
DELIVERABLES (PLEASE CIRCLE): TIER I TIER II/ECRA BUST				RESULTS ONLY		OTHER			

[illegible]

Client Retains Pink Copy Only

LABORATORY CHRONICLE

Sample I.D.: - 0E79792 79796

Date performed: Custody Time: Performed by:

Analyses:

COCAINE DETECTION

02/23/90

12:00-12:18

A. DAVIES

LABORATORY CHRONICLE

Sample I.D.: AB79782-79791

Date performed: Custody Time: Performed by:

Analyses:

LOSS ON IGNITION

02/19/98

15:15-15:45

A. DAVIES

LABORATORY CHRONICLE

Sample I.D. : AD79752 79796

Date performed: Custody Time: Performed by:

Analyst:

0000110

00/13/00

10:00-12:18

A. DAVIES

LABORATORY CHRONICLE

Sample I.D.: AB79702 79791

Date performed: Custody Time: Performed by:

03/10/90

6 SOLIDS

03/10/90

15:15-15:43

A. DAVIES

METHOD BLANKS AND METHOD BLANK SPIKES
(LABORATORY CONTROL SAMPLES)

SAMPLE(S) ID:

MATRIX:

UNITS:

ANALYTE	METHOD	DATE OF ANALYSIS	BLANK RESULT	SPIKE LEVEL	LCS	%REC
---------	--------	------------------	--------------	-------------	-----	------

Recovery Limit = 90 - 120%

SPIKE SAMPLE RESULTS SUMMARY

SAMPLE(S) ID:

MATRIX:

UNITS:

ANALYTE	METHOD	SPIKED SAMPLE#	DATE OF ANALYSIS	SAMPLE RESULT	SPIKE LEVEL	MS	%REC	MSD	%REC	MSD
---------	--------	----------------	------------------	---------------	-------------	----	------	-----	------	-----

Recovery Limit = 90 - 120% Relative Percent Difference Limit = 20%

DUPLICATE SAMPLE RESULTS SUMMARY

SAMPLE(S) ID: AB79702-79791

MATRIX: SOLID

UNITS: %

ANALYTE	METHOD	DUPLICATED SAMPLE #	SAMPLE RESULT	DUPLICATED SAMPLE RESULT	RED %
PERCHLOR	1267-86	AB79791	11.2	11.3	0.89

RELATIVE PERCENT DIFFERENCE LIMIT=20%

LABORATORY CHRONICLE

Sample ID: AB79782-796

Date performed Custody Time: Performed by:

Extractions:

Soil

03/03/98

12:00-16:30

S. Saylor

Analysis:

G&O

03/03/98

12:00-16:30

S. Saylor

METHOD BLANKS AND METHOD BLANK SPIKES
(LABORATORY CONTROL SAMPLES)

SAMPLE(S) ID:

MATRIX:

UNITS:

ANALYTE	METHOD	DATE OF ANALYSIS	BLANK RESULT	SPIKE LEVEL	LCS	%REC
---------	--------	------------------	--------------	-------------	-----	------

%Recovery Limit = 80 - 120%

SPIKE SAMPLE RESULTS SUMMARY

SAMPLE(S) ID:

MATRIX:

UNITS:

ANALYTE	METHOD	SPIKED SAMPLE#	DATE OF ANALYSIS	SAMPLE RESULT	SPIKE LEVEL	MS	%REC	MSD	%REC	RSD
---------	--------	----------------	------------------	---------------	-------------	----	------	-----	------	-----

RECOVERY LIMITS = 75 - 125% RELATIVE PERCENT DIFFERENCE LIMIT = 20%

DUPLICATE SAMPLE RESULTS SUMMARY

SAMPLE(S) ID:0B70002 70701

MATRIX:SOLID

UNITS:%

ANALYTE	METHOD	DUPLICATED SAMPLE #	SAMPLE RESULT	DUPLICATED SAMPLE RESULT	RED %
0B70002	100.0	0B70701	71.1	70.8	0.42

RELATIVE PERCENT DIFFERENCE LIMIT=20%

METHOD BLANKS AND METHOD BLANK SPIKES
(LABORATORY CONTROL SAMPLES)

SAMPLE(S) ID:

MATRIX:

UNITS:

ANALYTE	METHOD	DATE OF ANALYSIS	BLANK RESULT	SPIKE LEVEL	LLCS	%REC
---------	--------	------------------	--------------	-------------	------	------

%Recovery Limit = 80 - 120%

SPIKE SAMPLE RESULTS SUMMARY

SAMPLE(S) ID:

MATRIX:

UNITS:

ANALYTE	METHOD	SPIKED SAMPLE#	DATE OF ANALYSIS	SAMPLE RESULT	SPIKE LEVEL	MS	%REC	MSD	%REC	RED
---------	--------	----------------	------------------	---------------	-------------	----	------	-----	------	-----

%RECOVERY LIMITS = 70 - 120% RELATIVE PERCENT DIFFERENCE LIMIT = 20%

DUPLICATE SAMPLE RESULTS SUMMARY

SAMPLE(S) ID: AB79792 79796

MATRIX: SOLID

UNITS: %

ANALYTE	METHOD	DUPLICATED SAMPLE#	SAMPLE RESULT	DUPLICATED SAMPLE RESULT	RED %
1000100	1067-06	AB79792	11.8	11.1	6.11

RELATIVE PERCENT DIFFERENCE LIMIT=20%

METHOD BLANKS AND METHOD BLANK SPIKES
(LABORATORY CONTROL SAMPLES)

SAMPLES: AB79782-796

MATRIX: SOIL

UNITS: MG/KG

<u>ANALYTE</u>	<u>METHOD</u>	<u>DATE OF ANALYSIS</u>	<u>BLANK RESULT</u>	<u>SPIKE LEVEL</u>	<u>LCS RESULT</u>	<u>% REC</u>	<u>LCS RESULT</u>	<u>% REC</u>	<u>RPD</u>
O & G	413.2	3/3/98	<10.0	166.7					

% RECOVERY LIMIT = 80 - 120%

SPIKE SAMPLE RESULTS SUMMARY

MATRIX: SOIL

UNITS: MG/KG

<u>ANALYTE</u>	<u>METHOD</u>	<u>SPIKED SAMPLE #</u>	<u>DATE OF ANALYSIS</u>	<u>SAMPLE RESULT</u>	<u>SPIKE LEVEL</u>	<u>MS</u>	<u>%REC</u>	<u>MSD</u>	<u>%REC</u>	<u>RPD</u>
O & G	413.2	AB79793	3/3/98	<10.0	167	160.0	95.8	170.0	101.8	6.1

%RECOVERY LIMITS = 75 -125%

RELATIVE PERCENT DIFFERENCE LIMIT = 20%

DUPLICATE SAMPLE RESULTS SUMMARY

MATRIX: SOIL

UNITS: MG/KG

<u>ANALYTE</u>	<u>METHOD</u>	<u>DUPLICAT SAMPLE #</u>	<u>SAMPLE RESULT</u>	<u>DUPLICATED SAMPLE RESULT</u>	<u>RPD</u>
O & G	413.2	AB79793	<10.0	<10.0	0.0

RELATIVE PERCENT DIFFERENCE LIMIT = 20%

METHOD BLANKS AND METHOD BLANK SPIKES
(LABORATORY CONTROL SAMPLES)

SAMPLE(S) ID:

MATRIX:

UNITS:

ANALYTE	METHOD	DATE OF ANALYSIS	BLANK RESULT	SPIKE LEVEL	LCS	%REC
---------	--------	------------------	--------------	-------------	-----	------

%Recovery Limit = 00 - 100%

SPIKE SAMPLE RESULTS SUMMARY

SAMPLE(S) ID:

MATRIX:

UNITS:

ANALYTE	METHOD	SPIKED SAMPLE#	DATE OF ANALYSIS	SAMPLE RESULT	SPIKE LEVEL	MS	%REC	MSD	%REC	RPD
---------	--------	----------------	------------------	---------------	-------------	----	------	-----	------	-----

RECOVERY LIMITS = 70 - 100% RELATIVE PERCENT DIFFERENCE LIMIT = 20%

DUPLICATE SAMPLE RESULTS SUMMARY

SAMPLE(S) ID:AB79792-79796

MATRIX:SOLID

UNITS:%

ANALYTE	METHOD	DUPLICATED SAMPLE#	SAMPLE RESULT	DUPLICATED SAMPLE RESULT	RPD %
ACETONE	160.2	AB79792	50.6	56.5	3.65

RELATIVE PERCENT DIFFERENCE LIMIT=20%

Page #

Start Date

End Date

Time

Temp.

Analyst

Sample #	AB79782	783	784	785	786	787	788	789	
Client name	American Aquatic								
Crucible #	12	Q8	11	TZ	111	C	2	B	
A	Crucible wt. (g)	17.1982	48.8079	54.6278	50.5701	55.7916	56.8889	55.5148	57.0760
B	Crucible & Sample wt. (g)	37.8678	82.7374	71.6969	73.5921	74.3266	82.5359	74.6581	73.8511
C	Initial Sample wt (g)	20.6694	33.9295	16.4691	23.0220	18.5350	25.6470	19.1433	16.7751
D	FinalCrucible & Sample wt. (g)	31.6845 30.9947	74.7019 73.5307	65.6146 64.5693	66.0823 64.6651	68.2070 66.4668	74.8432 73.6813	67.7335 66.6060	67.9967 67.0116
E	Final Sample wt. (g)	14.4863	25.8940	10.9868	15.5122	12.4154	17.9543	18.2187	10.9207
F	% Solid	70.1%	76.3	66.7	67.4	67.0	70.0	63.8	65.1

B-A=C

D-A=E

E/C=F

1.6898

14.4863

41.76

 $D_1 - D_2$ $D_1 - A$

x100

1.1712

25.894

4.52

1.0453

9.9415

10.5

1.4172

15.5422

9.1290

1.7402

12.4154

14.0

1.1619

17.9543

6.47

1.1275

12.2187

9.23

.9851

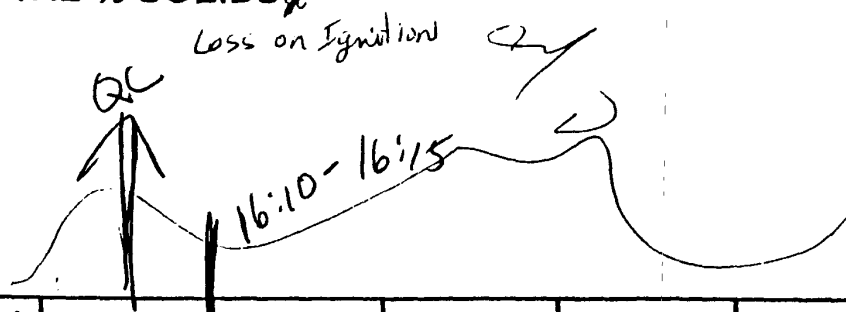
10.9207

9.02

TOTAL % SOLIDS

Loss on Ignition

Page # ②
 Start Date 2/19/98
 End Date 2/20/98
 Time 15:15-15:45
 Temp. _____
 Analyst AD



Sample #	AB79790	791	^{Rep.} 791	768	AB79810	811	812	
Client name	American Hydraulic			Wham	EC Group			
Crucible #	J	—	—	PR	m07	17	12	
A Crucible wt. (g)	49.4581	56.6182	59.4424	1.6105	1.6272	1.5379	1.6323	
B Crucible Sample wt. (g)	67.5897	75.2733	77.5064	14.7469	12.9259	13.9507	12.4841	
C Initial Sample wt. (g)	61.6306 60.3906	69.8825 68.4034	72.2260	13.1364	11.2987	12.4128	10.8518	
D Final Crucible Sample wt. (g)	18.1316	18.6551 13.2643	18.0640	12.5528	10.7325	11.3258	11.0128	
E Final Sample wt. (g)	12.1725	13.2643 11.7852	12.7834	10.9423	9.1053	9.7819	9.3804	
F % Solid	67.1	71.1 63.2	70.8	83.3	80.6	78.9	86.4	

0.050
445

0.05
0.05

B-A=C
 D-A=E
 E/C=F

1.2394
 12.1725
 10.2

7.9 70.43
 0.420089D
 11.3
 69.8825
 0.8901

1.4791
 13.2643
 11.4458
 12.7834

TOTAL % SOLIDS / L.O.I

Page # (1)
 Start Date 2/23/98
 End Date 2/24/98
 Time 1200-1218
 Temp. _____
 Analyst AD

10 15:30-16:50

Sample #	America ^{new dup}						AB79899	900
Client name	AB79792	792	793	794	795	796	EC Group	→
Crucible #	2	J	B	Qg	11	—	mp7	XF
A Crucible wt. (g)	55.5142	49.4162	57.0795	48.8118	54.6248	56.6218	1.6256	1.5854
B Crucible & Sample wt. (g)	74.0784	69.1328	78.1725	72.3421	69.4391	66.1493	11.6454	12.4288
C Initial Sample wt. (g)	18.5642	19.6666	21.0980	23.5303	14.8143	9.5275	10.6198	10.8434
D Final Crucible & Sample wt. (g)	66.3986	60.5870	70.4181	63.6932	65.9330	63.9008	10.7608	10.6867
E Final Sample wt. (g)	10.8844	11.1208	13.3384	14.8814	11.3082	7.2790	9.1412	9.1013
F % Solid	58.4	56.5	63.2	63.2	76.3	76.4	91.2	83.9

1050C
448°C

B-A=C
 D-A=E
 E/C=F

57.55

3.65% ^{Decom.}

$$\frac{D_1 - D_2}{D_1 - A} \times 100 = LOI$$

$\frac{1.2859}{10.8844} \times 100 = 11.8\%$
 $\frac{1.2369}{11.1209} \times 100 = 11.1\%$
 $\frac{1.2641}{13.3384} \times 100 = 9.48\%$
 $\frac{1.1034}{14.8814} \times 100 = 7.41\%$
 $\frac{1.6574}{11.3082} \times 100 = 5.81\%$
 $\frac{1.0605}{7.2790} \times 100 = 14.6\%$

Qt	By	Rel. Time	Sample	Test	pH	%T	Sample amt.	Final vol.	Result	
-	CB	10:00-12:00	AB79975	PHC	-	90.9	30.0	50	778	SS
0			AB79938		-	85.6	30.0	50	274	
			AB79977		-	79.2	30.0	50	<12.6	
			AB79978		-	83.1	30.0	50	<12.0	
		16:00-18:15	AB80008		-	79.9	30.0	50	<12.5	
			AB80009		-	77.3	30.0	50	<12.9	
2	SS		AB80010		-	80.2	30.0	50	17.6	
			AB80011		-	78.9	30.0	50	1280	
			AB80012		-	78.9	30.0	50	<12.7	
2		3-2-98	Blank	PHC	-	0.00	30.0	50	<10.0	LB/SS
		10:00	AB80028		-	84.5	30.0	50	57.4	
			AB80028 Dup		-	84.5	30.0	50	55.0	
			AB80028 MS		-	84.5	30.0	50	222	
			AB80028 MS D		-	84.5	30.0	50	226	
		11:00	AB79988 AB800	Gto	-	52.2	30.0	50	341	
		3-3-98	Blank	Gto	-	100.00	30.0	50	<10.0	SS
		12:00	AB79782		-	70.1	30.0	50	257	
			AB79783		-	76.3	30.0	50	284	
			AB79784		-	66.7	30.0	50	570	
			AB79785		-	67.4	30.0	50	351	
			AB79786		-	67.0	30.0	50	373	
			AB79787		-	70.0	30.0	50	533	
		16:30	AB79788		-	63.8	30.0	50	329	

Sample id	5-3-70 Before	5-4-70 After	wt in g	calc.	wet wt.	%S	D
Blank	94.2574	94.2574	0.0000	$\frac{0.0}{.03}$	<10.0	100.0	<10
AB79782	110.8465	110.8519	0.0054	$\frac{5.4}{.03}$	180.0	70.1	2
AB79783	105.0243	105.0331	.0088	$\frac{8.8}{.03}$	293.3	76.3	38
AB79784	107.0371	107.0485	.0114	$\frac{11.4}{.03}$	380.0	66.7	570
AB79785	104.9736	104.9807	.0071	$\frac{7.1}{.03}$	236.7	67.4	351
AB79786	102.4502	102.4577	.0075	$\frac{7.5}{.03}$	250.0	67.0	373
AB79787	103.2011	103.2123	.0112	$\frac{11.2}{.03}$	373	70.0	533
AB79788	99.0496	99.0559	.0063	$\frac{6.3}{.03}$	210	63.8	329
AB79789	112.6691	112.6902	.0211	$\frac{21.1}{.03}$	703	65.1	1080
AB79790	107.5799	107.5803	.0004	$\frac{.4}{.03}$	13.3	67.1	19.8
AB79791	94.0925	94.0962	.0036	$\frac{3.6}{.03}$	120	71.1	169
AB79792	108.5635	108.5670	.0035	$\frac{3.5}{.03}$	116.7	58.6	199
AB79793	104.5801	104.5803	.0002	$\frac{0.2}{0.03}$	<10.0	63.2	<15.8
AB79794	107.2691	107.2701	.0020	$\frac{2.0}{.03}$	66.67	63.2	105.5
AB79795	101.9199	101.9206	.0007	$\frac{.7}{.03}$	23.3	76.3	30.5
AB79796	95.2114	95.2197	.0083	$\frac{8.3}{.03}$	276.7	76.4	362
AB79793 Dup	106.4621	106.4623	.0002	$\frac{0.2}{0.03}$	<10.0	63.2	<15.8
AB79793 MS	103.6423	103.6471	.0048	$\frac{4.8}{.03}$	160	$160/167 = 95.8\%$	new
AB79793 MSD	105.4772	105.4823	.0051	$\frac{5.1}{.03}$	170	$170/167 = 101.8\%$	new RPD = 6

Date/Time	Sample	Test	pH	%TS	Sample amt	Final vol	Result	by
12:00	AB79789	G-to	-	65.1	30.0	50	1080.0	SS
	AB79790		-	67.1	30.0	50	67.1 19.8	830-
	AB79791		-	71.1	30.0	50	71.1 16.9	
	AB79792		-	58.6	30.0	50	58.6 19.9	
	AB79793		-	63.2	30.0	50	63.2 15.8	100-7
	AB79793dup		-	-	30.0	50	63.2 15.8	
	AB79793 ms		-	-	30.0	50	16.0	
16:30	AB79793 ms D		-	-	30.0	50	17.0	
12:00	AB79794		-	63.2	30.0	50	106	
	AB79795		-	76.3	30.0	50	30.5	100-
16:30	AB79796		-	76.4	30.0	50	3.62	3/10/
3/16/98	Blank	PHC N			30.0	50.0	<10.0	10.00
830-10:10	AB 80184			42.6	30.0		<10.0	
	187			93.2	30.0		<10.0	
	190			91.2	30.0		32.3	
	201			89.9	30.1		<10.0	
	205			89.9	30.2		<10.0	
	207			89.6	30.0		<10.0	
	210			89.6	30.1		114.3	
	209			95.9	30.3		187.9	
	211			80.9	30.1		200	
	212			87.7	30.0		244.4	

Client/Toxicant: 48
 Project Number: 02-01
 Species: H. azteca

Beginning Date & Time: 2/21/98 3:30pm
 Ending Date & Time: 3/7/98 2:00pm
 Hatch Date:

American Aquatic Testing, Inc.
 Weight Data

Conc.	Rep	Pan #	A weight of boat (g)	B weight of boat & org. (g)	(B-A)*1000=C dry weight of organisms (mg)	D # of surviving org.	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
Control	A	1	0.00497	0.00581	0.84	9	0.093	
	B	2	0.00462	0.00533	0.71	10	0.071	
	C	3	0.00517	0.00540	0.23	9	0.026	
	D	4	0.00456	0.00523	0.67	10	0.067	
	E	5	0.00446	0.00491	0.45	8	0.056	
	F	6	0.00487	0.00525	0.38	8	0.048	
	G	7	0.00539	0.00563	0.24	10	0.024	
	H	8	0.00524	0.00567	0.43	8	0.054	
Reference	A	9	0.00517	0.00576	0.59	9	0.066	
	B	10	0.00481	0.00525	0.44	8	0.055	
	C	11	0.00473	0.00510	0.37	9	0.041	
	D	12	0.00469	0.00503	0.34	10	0.034	
	E	13	0.00413	0.00429	0.16	8	0.020	
	F	14	0.00417	0.00450	0.33	7	0.047	
	G	15	0.00419	0.00442	0.23	9	0.026	
	H	16	0.00466	0.00498	0.32	8	0.040	
6%	A	17	0.00431	0.00473	0.42	6	0.070	
	B	18	0.00386	0.00411	0.25	4	0.063	
	C	19	0.00384	0.00390	0.06	3	0.020	
	D	20	0.00411	0.00427	0.16	5	0.032	
	E	21	0.00489	0.00519	0.30	6	0.050	
	F	22	0.00452	0.00488	0.36	5	0.072	
	G	23	0.00490	0.00500	0.10	4	0.025	
	H	24	0.00478	0.00510	0.32	4	0.080	
12%	A	-						
	B	25	0.00466	0.00480	0.14	1	0.140	
	C	-						
	D	-						
	E	26	0.00485	0.00499	0.14	1	0.140	
	F	27	0.00477	0.00498	0.21	3	0.070	
	G	28	0.00474	0.00489	0.15	2	0.075	
	H	29	0.00468	0.00474	0.06	1	0.060	
Initials			TAP	TAP	TAP	TAP	TAP	
Date			3/7	3/9	3/9	3/7	3/9	

E = Original number of organisms at test initiation, adjusted for losses.

Observations:

Client/Toxicant: 48
 Project Number: 02-01
 Species: Latex

Beginning Date & Time: 2/21/72 330pm
 Ending Date & Time: 3/7/72 200pm
 Hatch Date: -

American Aquatic Testing, Inc.
 Weight Data

Conc.	Rep	Pan #	A weight of boat (g)	B weight of boat & org. (g)	(B-A)*1000=C dry weight of organisms (mg)	D # of surviving org.	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
REM-1	A							
	B	31	0.00421	0.00428	0.07	1	0.070	
	C							
	D							
	E							
	F	32	0.00400	0.00413	0.13	1	0.130	
	G							
	H	33	0.00402	0.00407	0.05	1	0.050	
	A							
	B							
	C							
	D							
	E							
	F							
	G							
	H							
	A							
	B							
	C							
	D							
	E							
	F							
	G							
	H							
	A							
	B							
	C							
	D							
	E							
	F							
	G							
	H							
Initials			TAP	TAP	TAP	CA	TAP	
Date			3/7	3/9	3/9	0367	3/9	

E = Original number of organisms at test initiation, adjusted for losses.

Observations:

Client/Toxicant: 48
 Project Number: 02-01
 Species: C. tentans and H. azteca (Initial weights)

Beginning Date & Time: 2-20-98
 Ending Date & Time: 3-6-98
 Hatch Date: -

American Aquatic Testing, Inc.

Weight Data

Initial weights	Rep	Pan #	A weight of boat (g)	B weight of boat & org. (g)	(B-A)*1000=C dry weight of organisms (mg)	D # of surviving org.	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
Chironomid Tentans	A	1	0.00894	0.01027	1.33	10	0.133	
	B	2	0.00860	0.01069	2.09	10	0.209	
	C							
	D							
	E							
	F							
	G							
	H							
Hyalella azteca	A	1	0.00724	0.00779	0.55	10	0.055	
	B	2	0.00794	0.00835	0.41	10	0.041	
	C							
	D							
	E							
	F							
	G							
	H							
	A							
	B							
	C							
	D							
	E							
	F							
	G							
	H							
	A							
	B							
	C							
	D							
	E							
	F							
	G							
	H							
Initials	TAP		TAP		TAP		TAP	
Date	2/21		2/23		2/23		2/23	

E = Original number of organisms at test initiation, adjusted for losses.

Observations:

APPENDIX B

RAW DATA FOR *Hyaella azteca* 14 DAY

SURVIVAL AND GROWTH TEST

Client/Toxicant: 48
 Job Number: C2-01
 Species: H. azteca

Beginning Date & Time: 02/12/98 3:30 pm
 Ending Date & Time: 3/7/98 2:00 pm

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

Conc.	Rep.	Day														Day 14	
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	Observ	Final Count
ACTR	A	N	SD3W	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	B	N	103M	N	N	3D	N	N	N	N	N	N	N	N	N	N	0
	C	N	2D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	D	N	3D	N	N	N	1D	N	N	N	N	N	N	N	N	N	0
	E	N	4D1W	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	F	N	4D1M	N	N	1D	N	N	N	N	N	N	N	N	N	N	0
	G	N	2D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	H	N	1D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
REM-1	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	B	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	C	N	N	N	N	1M	N	N	N	N	N	N	N	N	N	IF	1
	D	N	N	N	N	N	1M	N	N	N	N	N	N	N	N	N	0
	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	F	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	G	N	N	N	N	N	N	N	N	N	N	1M	N	N	N	IF	1
	H	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0
REM-2	A	N	SD	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	B	N	2D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	C	N	2D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	D	N	1D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	E	N	3D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	F	N	4D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	G	N	4D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	H	N	SD1W	N	N	N	N	N	N	N	N	N	N	N	N	N	0
Initials		TPP	TPP	TPP	TPP	TPP	TPP	TPP	TPP	TPP	TPP	TPP	TPP	TPP	TPP	TPP	TPP
Date		2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/7

Key: D=dead, W=on water surface, M=swimming, F=on sediment surface, N=no observations

Comments:

Client/Toxicant: 48
 Job Number: 02-01
 Species: H. azteca

Beginning Date & Time: 02/21/98 3:30 pm
 Ending Date & Time: 3/7/98 7:00 pm

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Physical/Chemical Parameters

Parameter Concentration		Day														
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
TEMP (C)	Control	22.0	22.5	22.0	22.0	22.0	23.0	23.0	23.0	22.5	23.0	23.5	22.5	22.0	22.0	22.5
	Reference	22.0	22.5	22.0	22.0	22.0	23.0	23.0	23.0	22.5	23.0	23.5	22.5	22.0	22.0	22.5
	6%	22.0	22.5	22.0	22.0	22.0	23.0	23.0	23.0	22.5	23.0	23.5	22.5	22.0	22.0	22.5
	12%	22.0	22.5	22.0	22.0	22.0	23.0	23.0	23.0	22.5	23.0	23.5	22.5	22.0	22.0	22.5
	25%	22.0	22.5	22.0	22.0	22.0	23.0	23.0	23.0	22.5	23.0	23.5	22.5	22.0	22.0	22.5
	50%	22.0	22.5	22.0	22.0	22.0	23.0	23.0	23.0	22.5	23.0	23.5	22.5	22.0	22.0	22.5
	ACTR	22.0	22.5	22.0	22.0	22.0	23.0	23.0	23.0	22.5	23.0	23.5	22.5	22.0	22.0	22.5
	REM-1	22.0	22.5	22.0	22.0	22.0	23.0	23.0	23.0	22.5	23.0	23.5	22.5	22.0	22.0	22.5
REM-2	22.0	22.5	22.0	22.0	22.0	23.0	23.0	23.0	22.5	23.0	23.5	22.5	22.0	22.0	22.5	
Dissolved Oxygen (mg/L)	Control	6.5	6.9	6.6	6.8	6.5	6.1	7.3	7.1	6.9	6.7	5.9	6.4	6.0	6.8	6.7
	Reference	6.8	7.0	7.1	7.4	7.1	7.1	7.8	7.5	7.3	7.2	6.6	7.0	6.7	7.3	7.6
	6%	6.8	7.0	6.9	6.9	6.7	6.8	7.5	7.3	7.0	6.8	6.4	6.8	6.6	7.1	7.3
	12%	6.4	6.8	6.8	6.8	6.6	6.7	7.1	7.2	6.8	6.8	6.3	6.7	6.3	7.1	7.3
	25%	6.5	6.7	6.6	6.7	6.5	6.7	7.1	7.2	6.7	6.5	6.0	6.6	6.3	7.0	7.2
	50%	6.0	6.2	6.7	6.8	6.5	6.6	7.2	7.1	6.7	6.5	5.9	6.5	6.3	7.0	7.1
	ACTR	6.5	6.8	6.7	6.8	6.8	6.8	7.4	7.0	7.1	7.0	6.6	6.9	6.7	7.2	7.4
	REM-1	7.1	7.0	7.1	7.2	7.1	7.0	7.7	7.4	6.8	6.3	5.9	6.6	6.3	6.9	7.0
	REM-2	5.9	6.1	6.5	6.7	6.6	6.6	7.3	7.1	6.7	6.5	5.8	6.4	6.2	6.9	7.1
	Initials	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR
Date	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	

Concentration	Cond. (umhos)		Alkalinity (mg/L)		Hardness (mg/L)		Ammonia (mg/L)		pH	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Control	310	340	70	90	80	100	0.0	0.0	6.5	7.0
Reference	315	335	70	60	80	100	0.0	0.0	6.6	6.9
6%	315	360	80	80	90	110	0.0	0.0	6.7	6.9
12%	315	345	80	90	90	100	0.0	0.0	6.7	7.0
25%	315	345	80	80	90	110	0.0	0.0	6.7	7.0
50%	320	345	80	80	90	100	0.0	0.0	6.8	7.0
ACTR	310	330	80	80	90	90	0.0	0.0	6.8	7.0
REM-1	325	345	70	70	90	100	0.1	0.0	6.7	6.9
REM-2	320	360	70	90	100	110	0.1	0.0	6.8	7.1
Initials	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR
Date	02/21	03/07	02/21	03/07	02/21	03/07	02/21	03/07	02/21	03/07

Comments:

Client/Toxicant: 48
 Job Number: 02-01
 Species: H. azteca

Beginning Date & Time: 02/21/98 3:30 pm
 Ending Date & Time: 3/7/98 2:00 pm

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

Conc.	Rep.	Day														Day 14	
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	Observ	Final Count
Control	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	1F	9
	B	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10
	C	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9
	D	N	N	N	N	N	N	N	N	N	N	N	N	N	N	1M	10
	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	8
	F	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	8
	G	N	1W	N	N	N	N	N	N	N	N	N	N	N	1F1M	1F	8
	H	N	N	N	N	N	N	N	N	N	N	N	N	1M	N	2M1F	10
Reference	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2F	8
	B	N	N	N	N	N	N	N	N	N	N	N	X ⁰	N	N	1F1D	9
	C	N	N	N	N	N	N	N	N	N	N	N	N	N	N	1F1M	8
	D	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9
	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10
	F	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	8
	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	3F	7
	H	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2M	9
6%	A	N	N	1W	N	N	N	N	N	N	N	N	N	N	N	N	8
	B	N	N	N	N	N	N	N	N	N	N	N	N	N	N	1F	6
	C	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	4
	D	N	2D	N	N	N	N	N	N	N	N	N	N	N	N	N	3
	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5
	F	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	6
	G	N	1W	N	N	N	N	N	N	N	N	N	N	N	N	N	5
	H	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	4
Initials	CA	TAP	TAP	TAP	B	B	TAP	TAP	TAP	TAP	TAP	TAP	6	TAP	TAP	2F	4
Date	02/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/7	3/7

Key: D=dead, W=on water surface, M=swimming, F=on sediment surface, N=no observations

Comments:

① 3 w/m 02/24/98

Client/Toxicant: 48
 Job Number: 02-01
 Species: H. azteca

Beginning Date & Time: 02/21/98 5:30pm
 Ending Date & Time: 3/7/98 2:00pm

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

Conc.	Rep.	Day														Day 14	
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	Observ	Final Count
12%	A	N	1W	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	B	N	4D 1W	N	N	N	N	N	N	N	N	N	N	N	N	N	1
	C	N	2D 2W	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	D	N	2D 1W	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	E	N	2W	N	N	N	N	N	N	N	N	N	N	N	N	N	1
	F	N	3D	1W	N	N	N	N	N	N	N	N	N	N	N	N	3
	G	N	10 3W	N	N	N	N	N	N	N	N	N	N	N	N	N	2
	H	N	10 1W	N	N	N	N	N	N	N	N	N	N	N	N	N	1
25%	A	N	3D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	B	N	3D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	C	N	3D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	D	N	5W	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	E	N	3D 1W	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	F	N	2D 2W	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	G	N	3D 2W	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	H	N	4W	N	N	N	N	N	N	N	N	N	N	N	N	N	0
50%	A	N	2D	1D	N	N	N	N	N	N	N	N	N	N	N	N	0
	B	N	4D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	C	N	3D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	D	N	8D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	E	N	2D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	F	N	3D 1W	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	G	N	2D	N	N	N	N	N	N	N	N	N	N	N	N	N	0
	H	N	6D 1W	N	N	N	N	N	N	N	N	N	N	N	N	N	0
Initials		<u>TA</u>	<u>TA</u>	<u>TA</u>	<u>TA</u>	<u>TA</u>	<u>TA</u>	<u>TA</u>	<u>TA</u>	<u>TA</u>	<u>TA</u>	<u>TA</u>	<u>TA</u>	<u>TA</u>	<u>TA</u>	<u>TA</u>	<u>TA</u>
Date		<u>2/21</u>	<u>2/22</u>	<u>2/23</u>	<u>2/24</u>	<u>2/25</u>	<u>2/26</u>	<u>2/27</u>	<u>2/28</u>	<u>3/1</u>	<u>3/2</u>	<u>3/3</u>	<u>3/4</u>	<u>3/5</u>	<u>3/6</u>	<u>3/7</u>	<u>3/8</u>

Key: D=dead, W=on water surface, M=swimming, F=on sediment surface, N=no observations

Comments:

Freshwater Acute Test

American Aquatic Testing, Inc.

Job #: SRT #2

Start Date: 2-24-98

Species: H. azteca

Start Time: 2:00pm

Dilution Water: EPA Mod. Hard

Test Type: 48hr. SNR

Concentration ppm	Rep.	Dissolved Oxygen(mg/L)			Temperature (C)			Live Count		
		0 hr.	24 hr.	48 hr.	0 hr.	24 hr.	48 hr.	0 hr.	24 hr.	48 hr.
Control	A	8.2	7.9	7.6	23.0	21.5	23.0	10	10	10
	B	8.2	7.9	7.6	23.0	21.5	23.0	10	10	10
125	A	8.2	7.9	7.6	23.0	21.5	23.0	10	10	10
	B	8.2	7.9	7.7	23.0	21.5	23.0	10	10	9
250	A	8.2	8.1	7.8	23.0	21.5	23.0	10	9	8
	B	8.2	8.1	7.8	23.0	21.5	23.0	10	10	9
500	A	8.2	8.1	-	23.0	21.5	-	10	0 ¹⁰	-
	B	8.2	8.1	-	23.0	21.5	-	10	0 ¹⁰	-
1000	A	8.2	8.0	-	23.0	21.5	-	10	0 ¹⁰	-
	B	8.2	8.0	-	23.0	21.5	-	10	0 ¹⁰	-
2000	A	8.2	8.2	-	23.0	21.5	-	10	0 ¹⁰	-
	B	8.2	8.2	-	23.0	21.5	-	10	0 ¹⁰	-
Initials		TRP	PS	TRP	TRP	PS	TRP	TRP	PS	TRP
Date		2/24	2/25	2/26	2/24	2/25	2/26	2/24	2/25	2/26

Concentration ppm	Alkalinity (mg/L)			Hardness (mg/L)			Chlorine (mg/L)
	0 hr.	24 hr.	48 hr.	0 hr.	24 hr.	48 hr.	Sample 1
Control	90			90			
100% 2000	90			90			
Initials	TRP			TRP			
Date	2/24			2/24			

Concentration ppm	pH (std units)			Conductivity (umhos)		
	0 hr.	24 hr.	48 hr.	0 hr.	24 hr.	48 hr.
Control	7.1	6.9	6.9	305	305	310
125	7.1	7.0	7.0	550	550	550
250	7.2	7.2	7.2	800	800	800
500	7.3	7.3	-	1300	1300	-
1000	7.4	7.4	-	2300	2300	-
2000	7.6	7.6	-	4100	4100	-
Initials	TRP	PS	TRP	TRP	PS	TRP
Date	2/24	2/25	2/26	2/24	2/25	2/26

Observations:

48HR LC₅₀ - 315.5

KCHASRT# 02

H. azteca SRT #02 48 hr LC50 02/24/98

File: C:\toxstat\kchasrt#.02

Transform: NO TRANSFORM

Probit analysis - using smoothed proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	SMOOTHED PROPORTION	PREDICTED PROPORTION
125.00	20	1	0.0500	0.0500	0.0151
250.00	20	3	0.1500	0.1500	0.2281
500.00	20	20	1.0000	1.0000	0.9822
1000.00	20	20	1.0000	1.0000	1.0000
2000.00	20	20	1.0000	1.0000	1.0000

Est. Mu = 315.4466 Est. Sigma = 87.8514
sd = 26.1152 sd = 19.4591

Chi-Square lack of fit = 2.697 Likelihood lack of fit = 2.508
Table Chi-square = 7.810 (Alpha = 0.05, df = 3)

H. azteca SRT #02 48 hr LC50 02/24/98

File: C:\toxstat\kchasrt#.02

Transform: NO TRANSFORM

Probit LC Estimates

POINT	ESTIMATED END POINT	95% CONFIDENCE LIMITS	
LC10	202.8605	150.6894	255.0316
LC20	241.5090	195.1595	287.8585
LC30	269.3773	223.7255	315.0291
LC40	293.1897	245.6378	340.7417
LC50	315.4466	264.2609	366.6324
LC60	337.7035	281.4407	393.9664
LC70	361.5160	298.6199	424.4121
LC80	389.3843	317.6039	461.1646
LC90	428.0328	342.6144	513.4511

USEPA ERT

CHAIN OF CUSTODY RECORD

COC # 2335-0002

REAC, Edison, NJ
 Contact: Nancy Beckham
 732/494-4060
 WO#: 03347-142-001-2335-01
 EPA Contract 68-C4-0022

Project Name: Tennessee Products
 Location: Chattanooga, TN
 Site Phone:

LAB #	Tag	Sample #	Location	Matrix	Collected	Container/Preservative	Analysis Request
	F	2335-003	12%	Sediment	2/13/98	8 oz glass/4 C	TOC
	G	2335-003	12%	Sediment	2/13/98	8 oz glass/4 C	Oil/Grease
	H	2335-003	12%	Sediment	2/13/98	32 oz glass/4 C	H. azteca
	I	2335-003	12%	Sediment	2/13/98	32 oz glass/4 C	C. tentans
	F	2335-004	25%	Sediment	2/13/98	8 oz glass/4 C	TOC
	G	2335-004	25%	Sediment	2/13/98	8 oz glass/4 C	Oil/Grease
	H	2335-004	25%	Sediment	2/13/98	32 oz glass/4 C	H. azteca
	I	2335-004	25%	Sediment	2/13/98	32 oz glass/4 C	C. tentans
	F	2335-009	Reference-Soil	Soil	2/13/98	8 oz glass/4 C	TOC
	G	2335-009	Reference-Soil	Soil	2/13/98	8 oz glass/4 C	Oil/Grease
	F	2335-010	S-1	Soil	2/13/98	8 oz glass/4 C	TOC
	G	2335-010	S-1	Soil	2/13/98	8 oz glass/4 C	Oil/Grease
	F	2335-011	S-2	Soil	2/13/98	8 oz glass/4 C	TOC
	G	2335-011	S-2	Soil	2/13/98	8 oz glass/4 C	Oil/Grease
	F	2335-012	S-3	Soil	2/13/98	8 oz glass/4 C	TOC
	G	2335-012	S-3	Soil	2/13/98	8 oz glass/4 C	Oil/Grease
	F	2335-013	S-4	Soil	2/13/98	8 oz glass/4 C	TOC
	G	2335-013	S-4	Soil	2/13/98	8 oz glass/4 C	Oil/Grease
	G	2335-014	S-5	Soil	2/13/98	8 oz glass/4 C	Oil/Grease
	G	2335-015	S-TA	Soil	2/13/98	8 oz glass/4 C	Oil/Grease

Special Instructions:

REFERENCE COC:

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date
all / analysis	Michelle Chipalotin	2/17/98	[Signature]	2/17/98	17:5			

USEPA ERT

CHAIN OF CUSTODY RECORD

COC # 2335-0001

REAC, Edison, NJ
Contact: Nancy Beckham
732/494-4060
WON#: 03347-142-001-2335-01
EPA Contract 68-C4-0022

Project Name: Tennessee Products
Location: Chattanooga, TN
Site Phone:

LAB #	Tag	Sample #	Location	Matrix	Collected	Container/Preservative	Analysis Request
	F	2335-006	REM-1	Sediment	2/13/98	8 oz glass/4 C	TOC
	G	2335-006	REM-1	Sediment	2/13/98	8 oz glass/4 C	Oil/Grease
	H	2335-006	REM-1	Sediment	2/13/98	32 oz glass/4 C	H. azteca
	I	2335-006	REM-1	Sediment	2/13/98	32 oz glass/4 C 2 jars	C. tentans
	F	2335-007	REM-2	Sediment	2/13/98	8 oz glass/4 C 2 jars	TOC
	G	2335-007	REM-2	Sediment	2/13/98	8 oz glass/4 C	Oil/Grease
	H	2335-007	REM-2	Sediment	2/13/98	32 oz glass/4 C	H. azteca
	I	2335-007	REM-2	Sediment	2/13/98	32 oz glass/4 C 2 jars	C. tentans
	F	2335-008	ACTR	Sediment	2/13/98	8 oz glass/4 C 2 jars	TOC
	G	2335-008	ACTR	Sediment	2/13/98	8 oz glass/4 C	Oil/Grease
	H	2335-008	ACTR	Sediment	2/13/98	32 oz glass/4 C 2 jars	H. azteca
	I	2335-008	ACTR	Sediment	2/13/98	32 oz glass/4 C 2 jars	C. tentans

Special Instructions:

REFERENCE COC:

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date
all analysis	Michelle Lopez	2/17/98	[Signature]	2/17/98	1715			

USEPA ERT

CHAIN OF CUSTODY RECORD

COC # 2335-0003

REAC, Edison, NJ
Contact: Nancy Beckham
732/494-4060
WO#: 03347-142-001-2335-01
EPA Contract 68-C4-0022

Project Name: Tennessee Products
Location: Chattanooga, TN
Site Phone:

[illegible]

Special Instructions:

REFERENCE COC:

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date
all / analysis	Michelle Chapalote	2/17/98	[Signature]	2/17/98	17:5			

USEPA ERT

CHAIN OF CUSTODY RECORD

COC # 2335-0016

REAC, Edison, NJ
Contact: Nancy Beckham
732/494-4060
WO#: 03347-142-001-2335-01
EPA Contract 68-C4-0022

Project Name: Tennessee Products
Location: Chattanooga, TN
Site Phone:

LAB #	Tag	Sample #	Location	Matrix	Collected	Container/Preservative	Analysis Request
	F	2335-001	reference	Sediment	2/13/98	8 oz glass/4 C	TOC
	G	2335-001	reference	Sediment	2/13/98	8 oz glass/4 C	Oil/Grease
	H	2335-001	reference	Sediment	2/13/98	32 oz glass/4 C	H. azteca
	I	2335-001	reference	Sediment	2/13/98	32 oz glass/4 C	C. tentans
	F	2335-002	6%	Sediment	2/13/98	8 oz glass/4 C	TOC
	G	2335-002	6%	Sediment	2/13/98	8 oz glass/4 C	Oil/Grease
	H	2335-002	6%	Sediment	2/13/98	32 oz glass/4 C	H. azteca
	I	2335-002	6%	Sediment	2/13/98	32 oz glass/4 C	C. tentans
	F	2335-005	50%	Sediment	2/13/98	8 oz glass/4 C	TOC
	G	2335-005	50%	Sediment	2/13/98	8 oz glass/4 C	Oil/Grease
	H	2335-005	50%	Sediment	2/13/98	32 oz glass/4 C	H. azteca
	I	2335-005	50%	Sediment	2/13/98	32 oz glass/4 C	C. tentans

Special Instructions:

REFERENCE COC:

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date
All / Analysis	Jennifer Royce	2/17/98	[Signature]	02/17/98	17:5			

TITLE: REAC Tennessee Prod. H.azteca survival data 02/21/98
 FILE: c:\toxstat\480201ha.s01
 TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 8

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	control	1	0.9000	1.2490
1	control	2	1.0000	1.4120
1	control	3	0.9000	1.2490
1	control	4	1.0000	1.4120
1	control	5	0.8000	1.1071
1	control	6	0.8000	1.1071
1	control	7	1.0000	1.4120
1	control	8	0.8000	1.1071
2	6%	1	0.6000	0.8861
2	6%	2	0.4000	0.6847
2	6%	3	0.3000	0.5796
2	6%	4	0.5000	0.7854
2	6%	5	0.6000	0.8861
2	6%	6	0.5000	0.7854
2	6%	7	0.4000	0.6847
2	6%	8	0.4000	0.6847
3	12%	1	0.0000	0.1588
3	12%	2	0.1000	0.3218
3	12%	3	0.0000	0.1588
3	12%	4	0.0000	0.1588
3	12%	5	0.1000	0.3218
3	12%	6	0.3000	0.5796
3	12%	7	0.2000	0.4636
3	12%	8	0.1000	0.3218
4	25%	1	0.0000	0.1588
4	25%	2	0.0000	0.1588
4	25%	3	0.0000	0.1588
4	25%	4	0.0000	0.1588
4	25%	5	0.0000	0.1588
4	25%	6	0.0000	0.1588
4	25%	7	0.0000	0.1588
4	25%	8	0.0000	0.1588
5	50%	1	0.0000	0.1588
5	50%	2	0.0000	0.1588
5	50%	3	0.0000	0.1588
5	50%	4	0.0000	0.1588
5	50%	5	0.0000	0.1588
5	50%	6	0.0000	0.1588
5	50%	7	0.0000	0.1588
5	50%	8	0.0000	0.1588
6	ACTR	1	0.0000	0.1588
6	ACTR	2	0.0000	0.1588
6	ACTR	3	0.0000	0.1588
6	ACTR	4	0.0000	0.1588
6	ACTR	5	0.0000	0.1588
6	ACTR	6	0.0000	0.1588
6	ACTR	7	0.0000	0.1588
6	ACTR	8	0.0000	0.1588
7	REM-1	1	0.0000	0.1588
7	REM-1	2	0.1000	0.3218

APPENDIX C

STATISTICAL DATA FOR *Hyaella azteca* 14 DAY

SURVIVAL AND GROWTH TEST

USING LABORATORY CONTROL SEDIMENT

REAC Tennessee Prod. H.azteca survival data 02/21/98

File: c:\toxstat\480201ha.s01

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	control	8	1.107	1.412	1.257
2	6%	8	0.580	0.886	0.747
3	12%	8	0.159	0.580	0.311
4	25%	8	0.159	0.159	0.159
5	50%	8	0.159	0.159	0.159
6	ACTR	8	0.159	0.159	0.159
7	REM-1	8	0.159	0.322	0.220
8	REM-2	8	0.159	0.159	0.159

REAC Tennessee Prod. H.azteca survival data 02/21/98

File: c:\toxstat\480201ha.s01

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	control	0.020	0.141	0.050	11.23
2	6%	0.012	0.108	0.038	14.42
3	12%	0.024	0.154	0.054	49.48
4	25%	0.000	0.000	0.000	0.00
5	50%	0.000	0.000	0.000	0.00
6	ACTR	0.000	0.000	0.000	0.00
7	REM-1	0.007	0.084	0.030	38.36
8	REM-2	0.000	0.000	0.000	0.00

7	REM-1	3	0.0000	0.1588
7	REM-1	4	0.0000	0.1588
7	REM-1	5	0.0000	0.1588
7	REM-1	6	0.1000	0.3218
7	REM-1	7	0.0000	0.1588
7	REM-1	8	0.1000	0.3218
8	REM-2	1	0.0000	0.1588
8	REM-2	2	0.0000	0.1588
8	REM-2	3	0.0000	0.1588
8	REM-2	4	0.0000	0.1588
8	REM-2	5	0.0000	0.1588
8	REM-2	6	0.0000	0.1588
8	REM-2	7	0.0000	0.1588
8	REM-2	8	0.0000	0.1588

REAC Tennessee Prod. H.azteca survival data 02/21/98
 File: c:\toxstat\480201ha.s01 Transform: ARC SINE(SQUARE ROOT(Y))

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
EXPECTED	4.288	15.488	24.448	15.488	4.288
OBSERVED	1	14	39	9	1

Calculated Chi-Square goodness of fit test statistic = 16.5649
 Table Chi-Square value (alpha = 0.01) = 13.277

Data FAIL normality test. Try another transformation.

Warning - The first three homogeneity tests are sensitive to non-normal data and should not be performed.

REAC Tennessee Prod. H.azteca survival data 02/21/98
 File: c:\toxstat\480201ha.s01 Transform: ARC SINE(SQUARE ROOT(Y))

Hartley's test for homogeneity of variance
 Bartlett's test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption.
 Additional transformations are useless.

REAC Tennessee Prod. H.azteca survival data 02/21/98
 File: c:\toxstat\480201ha.s01 Transform: ARC SINE(SQUARE ROOT(Y))

STEEL'S MANY-ONE RANK TEST			- Ho:Control<Treatment			
GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	control	1.257				
2	6%	0.747	36.00	45.00	8.00	*
3	12%	0.311	36.00	45.00	8.00	*
4	25%	0.159	36.00	45.00	8.00	*
5	50%	0.159	36.00	45.00	8.00	*
6	ACTR	0.159	36.00	45.00	8.00	*
7	REM-1	0.220	36.00	45.00	8.00	*
8	REM-2	0.159	36.00	45.00	8.00	*

TITLE: REAC Tennessee Prod. H.azteca growht data 02/21/98

FILE: c:\toxstat\480201ha.g01

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 4

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	control	1	0.0930	0.0930
1	control	2	0.0710	0.0710
1	control	3	0.0260	0.0260
1	control	4	0.0670	0.0670
1	control	5	0.0560	0.0560
1	control	6	0.0480	0.0480
1	control	7	0.0240	0.0240
1	control	8	0.0540	0.0540
2	6%	1	0.0700	0.0700
2	6%	2	0.0630	0.0630
2	6%	3	0.0200	0.0200
2	6%	4	0.0320	0.0320
2	6%	5	0.0500	0.0500
2	6%	6	0.0720	0.0720
2	6%	7	0.0250	0.0250
2	6%	8	0.0800	0.0800
3	12%	1	0.0000	0.0000
3	12%	2	0.1400	0.1400
3	12%	3	0.0000	0.0000
3	12%	4	0.0000	0.0000
3	12%	5	0.1400	0.1400
3	12%	6	0.0700	0.0700
3	12%	7	0.0750	0.0750
3	12%	8	0.0600	0.0600
4	REM-1	1	0.0000	0.0000
4	REM-1	2	0.0700	0.0700
4	REM-1	3	0.0000	0.0000
4	REM-1	4	0.0000	0.0000
4	REM-1	5	0.0000	0.0000
4	REM-1	6	0.1300	0.1300
4	REM-1	7	0.0000	0.0000
4	REM-1	8	0.0500	0.0500

REAC Tennessee Prod. C.tentans growth data 02/20/98
 File: 480201ct.g02 Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	3.752	13.552	21.392	13.552	3.752
OBSERVED	3	11	28	8	6

Calculated Chi-Square goodness of fit test statistic = 6.2939
 Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

REAC Tennessee Prod. C.tentans growth data 02/20/98
 File: 480201ct.g02 Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
 Calculated B1 statistic = 30.51

Table Chi-square value = 16.81 (alpha = 0.01, df = 6)
 Table Chi-square value = 12.59 (alpha = 0.05, df = 6)

Data FAIL B1 homogeneity test at 0.01 level. Try another transformation.

REAC Tennessee Prod. C.tentans growth data 02/20/98
 File: 480201ct.g02 Transform: NO TRANSFORMATION

STEEL'S MANY-ONE RANK TEST			- Ho:Control<Treatment			
GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	Reference	1.049				
2	6%	0.936	56.00	46.00	8.00	
3	12%	1.115	75.00	46.00	8.00	
4	25%	0.462	44.00	46.00	8.00	*
5	50%	0.148	37.00	46.00	8.00	*
6	REM-1	0.986	62.00	46.00	8.00	
7	REM-2	0.868	57.00	46.00	8.00	

Critical values use k = 6, are 1 tailed, and alpha = 0.05

REAC Tennessee Prod. C.tentans growth data 02/20/98
 File: 480201ct.g02 Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Reference	8	0.715	1.466	1.049
2	6%	8	0.701	1.249	0.936
3	12%	8	0.896	1.290	1.115
4	25%	8	0.000	1.935	0.462
5	50%	8	0.000	0.800	0.148
6	REM-1	8	0.757	1.246	0.986
7	REM-2	8	0.000	1.890	0.868

REAC Tennessee Prod. C.tentans growth data 02/20/98
 File: 480201ct.g02 Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Reference	0.051	0.226	0.080	21.59
2	6%	0.030	0.173	0.061	18.51
3	12%	0.020	0.143	0.051	12.83
4	25%	0.421	0.649	0.229	140.47
5	50%	0.087	0.295	0.104	200.19
6	REM-1	0.023	0.152	0.054	15.37
7	REM-2	0.313	0.560	0.198	64.47

TITLE: REAC Tennessee Prod. C.tentans growth data 02/20/98
 FILE: 480201ct.g02
 TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Reference	1	0.9420	0.9420
1	Reference	2	0.7150	0.7150
1	Reference	3	1.0890	1.0890
1	Reference	4	1.1280	1.1280
1	Reference	5	1.4660	1.4660
1	Reference	6	1.0580	1.0580
1	Reference	7	1.1510	1.1510
1	Reference	8	0.8400	0.8400
2	6%	1	1.0260	1.0260
2	6%	2	0.8990	0.8990
2	6%	3	0.7430	0.7430
2	6%	4	0.7010	0.7010
2	6%	5	0.9110	0.9110
2	6%	6	1.0330	1.0330
2	6%	7	0.9240	0.9240
2	6%	8	1.2490	1.2490
3	12%	1	0.9830	0.9830
3	12%	2	1.0600	1.0600
3	12%	3	1.0900	1.0900
3	12%	4	1.0810	1.0810
3	12%	5	1.2760	1.2760
3	12%	6	1.2900	1.2900
3	12%	7	0.8960	0.8960
3	12%	8	1.2430	1.2430
4	25%	1	1.9350	1.9350
4	25%	2	0.6600	0.6600
4	25%	3	0.2900	0.2900
4	25%	4	0.2300	0.2300
4	25%	5	0.5800	0.5800
4	25%	6	0.0000	0.0000
4	25%	7	0.0000	0.0000
4	25%	8	0.0000	0.0000
5	50%	1	0.3800	0.3800
5	50%	2	0.8000	0.8000
5	50%	3	0.0000	0.0000
5	50%	4	0.0000	0.0000
5	50%	5	0.0000	0.0000
5	50%	6	0.0000	0.0000
5	50%	7	0.0000	0.0000
5	50%	8	0.0000	0.0000
6	REM-1	1	0.7570	0.7570
6	REM-1	2	1.1010	1.1010
6	REM-1	3	0.9430	0.9430
6	REM-1	4	0.9060	0.9060
6	REM-1	5	1.0400	1.0400
6	REM-1	6	1.0320	1.0320
6	REM-1	7	1.2460	1.2460
6	REM-1	8	0.8660	0.8660
7	REM-2	1	0.7100	0.7100
7	REM-2	2	1.0050	1.0050

7	REM-2	3	1.2100	1.2100
7	REM-2	4	0.6700	0.6700
7	REM-2	5	0.4500	0.4500
7	REM-2	6	1.8900	1.8900
7	REM-2	7	1.0100	1.0100
7	REM-2	8	0.0000	0.0000

REAC Tennessee Prod. C.tentans survival data 02/20/98
 File: 480201ct.s02 Transform: ARC SINE(SQUARE ROOT(Y))

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	4.288	15.488	24.448	15.488	4.288
OBSERVED	2	16	31	12	3

Calculated Chi-Square goodness of fit test statistic = 4.1661
 Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

REAC Tennessee Prod. C.tentans survival data 02/20/98
 File: 480201ct.s02 Transform: ARC SINE(SQUARE ROOT(Y))

Hartley's test for homogeneity of variance
 Bartlett's test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption.
 Additional transformations are useless.

REAC Tennessee Prod. C.tentans survival data 02/20/98
 File: 480201ct.s02 Transform: ARC SINE(SQUARE ROOT(Y))

STEEL'S MANY-ONE RANK TEST			- Ho:Control<Treatment			
GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	Reference	1.131				
2	6%	1.085	60.00	45.00	8.00	
3	12%	0.903	42.50	45.00	8.00	*
4	25%	0.278	36.00	45.00	8.00	*
5	50%	0.232	36.00	45.00	8.00	*
6	ACTR	0.159	36.00	45.00	8.00	*
7	REM-1	1.119	64.00	45.00	8.00	
8	REM-2	0.405	36.00	45.00	8.00	*

Critical values use k = 7, are 1 tailed, and alpha = 0.05

REAC Tennessee Prod. C.tentans survival data 02/20/98
 File: 480201ct.s02 Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Reference	8	0.991	1.249	1.131
2	6%	8	0.991	1.249	1.085
3	12%	8	0.685	1.107	0.903
4	25%	8	0.159	0.464	0.278
5	50%	8	0.159	0.580	0.232
6	ACTR	8	0.159	0.159	0.159
7	REM-1	8	0.991	1.412	1.119
8	REM-2	8	0.159	0.580	0.405

REAC Tennessee Prod. C.tentans survival data 02/20/98
 File: 480201ct.s02 Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Reference	0.012	0.109	0.038	9.60
2	6%	0.013	0.113	0.040	10.46
3	12%	0.020	0.142	0.050	15.70
4	25%	0.012	0.110	0.039	39.53
5	50%	0.023	0.152	0.054	65.45
6	ACTR	0.000	0.000	0.000	0.00
7	REM-1	0.022	0.147	0.052	13.17
8	REM-2	0.017	0.130	0.046	32.19

TITLE: REAC Tennessee Prod. C.tentans survival data 02/20/98
 FILE: 480201ct.s02
 TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 8

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Reference	1	0.7000	0.9912
1	Reference	2	0.8000	1.1071
1	Reference	3	0.8000	1.1071
1	Reference	4	0.9000	1.2490
1	Reference	5	0.7000	0.9912
1	Reference	6	0.9000	1.2490
1	Reference	7	0.8000	1.1071
1	Reference	8	0.9000	1.2490
2	6%	1	0.7000	0.9912
2	6%	2	0.7000	0.9912
2	6%	3	0.8000	1.1071
2	6%	4	0.9000	1.2490
2	6%	5	0.9000	1.2490
2	6%	6	0.7000	0.9912
2	6%	7	0.7000	0.9912
2	6%	8	0.8000	1.1071
3	12%	1	0.8000	1.1071
3	12%	2	0.5000	0.7854
3	12%	3	0.4000	0.6847
3	12%	4	0.7000	0.9912
3	12%	5	0.5000	0.7854
3	12%	6	0.6000	0.8861
3	12%	7	0.7000	0.9912
3	12%	8	0.7000	0.9912
4	25%	1	0.2000	0.4636
4	25%	2	0.1000	0.3218
4	25%	3	0.1000	0.3218
4	25%	4	0.1000	0.3218
4	25%	5	0.1000	0.3218
4	25%	6	0.0000	0.1588
4	25%	7	0.0000	0.1588
4	25%	8	0.0000	0.1588
5	50%	1	0.3000	0.5796
5	50%	2	0.1000	0.3218
5	50%	3	0.0000	0.1588
5	50%	4	0.0000	0.1588
5	50%	5	0.0000	0.1588
5	50%	6	0.0000	0.1588
5	50%	7	0.0000	0.1588
5	50%	8	0.0000	0.1588
6	ACTR	1	0.0000	0.1588
6	ACTR	2	0.0000	0.1588
6	ACTR	3	0.0000	0.1588
6	ACTR	4	0.0000	0.1588
6	ACTR	5	0.0000	0.1588
6	ACTR	6	0.0000	0.1588
6	ACTR	7	0.0000	0.1588
6	ACTR	8	0.0000	0.1588
7	REM-1	1	0.7000	0.9912

7	REM-1	2	1.0000	1.4120
7	REM-1	3	0.8000	1.1071
7	REM-1	4	0.8000	1.1071
7	REM-1	5	0.7000	0.9912
7	REM-1	6	0.9000	1.2490
7	REM-1	7	0.7000	0.9912
7	REM-1	8	0.8000	1.1071
8	REM-2	1	0.2000	0.4636
8	REM-2	2	0.2000	0.4636
8	REM-2	3	0.2000	0.4636
8	REM-2	4	0.3000	0.5796
8	REM-2	5	0.2000	0.4636
8	REM-2	6	0.1000	0.3218
8	REM-2	7	0.1000	0.3218
8	REM-2	8	0.0000	0.1588

APPENDIX G

STATISTICAL DATA FOR *Chironomus tentans* 14 DAY

SURVIVAL AND GROWTH TEST

USING TENNESSEE SITE REFERENCE SEDIMENT

REAC Tennessee Prod. C.tentans growth data 02/21/98

File: c:\toxstat\480201ct.g01

Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	3.752	13.552	21.392	13.552	3.752
OBSERVED	3	13	25	9	6

Calculated Chi-Square goodness of fit test statistic = 3.6576

Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

REAC Tennessee Prod. C.tentans growth data 02/21/98

File: c:\toxstat\480201ct.g01

Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 32.39

Table Chi-square value = 16.81 (alpha = 0.01, df = 6)

Table Chi-square value = 12.59 (alpha = 0.05, df = 6)

Data FAIL B1 homogeneity test at 0.01 level. Try another transformation.

REAC Tennessee Prod. C.tentans growth data 02/21/98

File: c:\toxstat\480201ct.g01

Transform: NO TRANSFORMATION

STEEL'S MANY-ONE RANK TEST

- Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	control	1.092				
2	6%	0.936	50.00	46.00	8.00	
3	12%	1.115	70.00	46.00	8.00	
4	25%	0.462	44.00	46.00	8.00	*
5	50%	0.148	36.00	46.00	8.00	*
6	REM-1	0.986	57.00	46.00	8.00	
7	REM-2	0.868	58.00	46.00	8.00	

Critical values use k = 6, are 1 tailed, and alpha = 0.05

REAC Tennessee Prod. C.tentans growth data 02/21/98

File: c:\toxstat\480201ct.g01

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	control	8	0.931	1.381	1.092
2	6%	8	0.701	1.249	0.936
3	12%	8	0.896	1.290	1.115
4	25%	8	0.000	1.935	0.462
5	50%	8	0.000	0.800	0.148
6	REM-1	8	0.757	1.246	0.986
7	REM-2	8	0.000	1.890	0.868

REAC Tennessee Prod. C.tentans growth data 02/21/98

File: c:\toxstat\480201ct.g01

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	control	0.034	0.184	0.065	16.86
2	6%	0.030	0.173	0.061	18.51
3	12%	0.020	0.143	0.051	12.83
4	25%	0.421	0.649	0.229	140.47
5	50%	0.087	0.295	0.104	200.19
6	REM-1	0.023	0.152	0.054	15.37
7	REM-2	0.313	0.560	0.198	64.47

7	REM-2	3	1.2100	1.2100
7	REM-2	4	0.6700	0.6700
7	REM-2	5	0.4500	0.4500
7	REM-2	6	1.8900	1.8900
7	REM-2	7	1.0100	1.0100
7	REM-2	8	0.0000	0.0000

REAC Tennessee Prod. C.tentans survival data 02/20/98
 File: 480201ct.s01 Transform: ARC SINE(SQUARE ROOT(Y))

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	4.288	15.488	24.448	15.488	4.288
OBSERVED	2	18	30	11	3

Calculated Chi-Square goodness of fit test statistic = 4.5765

Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

REAC Tennessee Prod. C.tentans survival data 02/20/98
 File: 480201ct.s01 Transform: ARC SINE(SQUARE ROOT(Y))

Hartley's test for homogeneity of variance

Bartlett's test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption.
 Additional transformations are useless.

REAC Tennessee Prod. C.tentans survival data 02/20/98
 File: 480201ct.s01 Transform: ARC SINE(SQUARE ROOT(Y))

STEEL'S MANY-ONE RANK TEST - Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	control	1.219				
2	6%	1.085	50.00	45.00	8.00	**
3	12%	0.903	38.00	45.00	8.00	*
4	25%	0.278	36.00	45.00	8.00	*
5	50%	0.232	36.00	45.00	8.00	*
6	ACTR	0.159	36.00	45.00	8.00	*
7	REM-1	1.119	54.00	45.00	8.00	**
8	REM-2	0.405	36.00	45.00	8.00	*

Critical values use k = 7, are 1 tailed, and alpha = 0.05

TITLE: REAC Tennessee Prod. C.tentans growth data 02/21/98
 FILE: c:\toxstat\480201ct.g01
 TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	control	1	0.9460	0.9460
1	control	2	1.1750	1.1750
1	control	3	0.9500	0.9500
1	control	4	1.3810	1.3810
1	control	5	1.0920	1.0920
1	control	6	0.9360	0.9360
1	control	7	1.3270	1.3270
1	control	8	0.9310	0.9310
2	6%	1	1.0260	1.0260
2	6%	2	0.8990	0.8990
2	6%	3	0.7430	0.7430
2	6%	4	0.7010	0.7010
2	6%	5	0.9110	0.9110
2	6%	6	1.0330	1.0330
2	6%	7	0.9240	0.9240
2	6%	8	1.2490	1.2490
3	12%	1	0.9830	0.9830
3	12%	2	1.0600	1.0600
3	12%	3	1.0900	1.0900
3	12%	4	1.0810	1.0810
3	12%	5	1.2760	1.2760
3	12%	6	1.2900	1.2900
3	12%	7	0.8960	0.8960
3	12%	8	1.2430	1.2430
4	25%	1	1.9350	1.9350
4	25%	2	0.6600	0.6600
4	25%	3	0.2900	0.2900
4	25%	4	0.2300	0.2300
4	25%	5	0.5800	0.5800
4	25%	6	0.0000	0.0000
4	25%	7	0.0000	0.0000
4	25%	8	0.0000	0.0000
5	50%	1	0.3800	0.3800
5	50%	2	0.8000	0.8000
5	50%	3	0.0000	0.0000
5	50%	4	0.0000	0.0000
5	50%	5	0.0000	0.0000
5	50%	6	0.0000	0.0000
5	50%	7	0.0000	0.0000
5	50%	8	0.0000	0.0000
6	REM-1	1	0.7570	0.7570
6	REM-1	2	1.1010	1.1010
6	REM-1	3	0.9430	0.9430
6	REM-1	4	0.9060	0.9060
6	REM-1	5	1.0400	1.0400
6	REM-1	6	1.0320	1.0320
6	REM-1	7	1.2460	1.2460
6	REM-1	8	0.8660	0.8660
7	REM-2	1	0.7100	0.7100
7	REM-2	2	1.0050	1.0050

REAC Tennessee Prod. C.tentans survival data 02/20/98
 File: 480201ct.s01 Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	control	8	1.107	1.412	1.219
2	6%	8	0.991	1.249	1.085
3	12%	8	0.685	1.107	0.903
4	25%	8	0.159	0.464	0.278
5	50%	8	0.159	0.580	0.232
6	ACTR	8	0.159	0.159	0.159
7	REM-1	8	0.991	1.412	1.119
8	REM-2	8	0.159	0.580	0.405

REAC Tennessee Prod. C.tentans survival data 02/20/98
 File: 480201ct.s01 Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	control	0.018	0.134	0.048	11.02
2	6%	0.013	0.113	0.040	10.46
3	12%	0.020	0.142	0.050	15.70
4	25%	0.012	0.110	0.039	39.53
5	50%	0.023	0.152	0.054	65.45
6	ACTR	0.000	0.000	0.000	0.00
7	REM-1	0.022	0.147	0.052	13.17
8	REM-2	0.017	0.130	0.046	32.19

7	REM-1	2	1.0000	1.4120
7	REM-1	3	0.8000	1.1071
7	REM-1	4	0.8000	1.1071
7	REM-1	5	0.7000	0.9912
7	REM-1	6	0.9000	1.2490
7	REM-1	7	0.7000	0.9912
7	REM-1	8	0.8000	1.1071
8	REM-2	1	0.2000	0.4636
8	REM-2	2	0.2000	0.4636
8	REM-2	3	0.2000	0.4636
8	REM-2	4	0.3000	0.5796
8	REM-2	5	0.2000	0.4636
8	REM-2	6	0.1000	0.3218
8	REM-2	7	0.1000	0.3218
8	REM-2	8	0.0000	0.1588

APPENDIX F

STATISTICAL DATA FOR *Chironomus tentans* 14 DAY

SURVIVAL AND GROWTH TEST

USING LABORATORY CONTROL SEDIMENT

TITLE: REAC Tennessee Prod. C.tentans survival data 02/20/98
 FILE: 480201ct.s01
 TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 8

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	control	1	1.0000	1.4120
1	control	2	0.8000	1.1071
1	control	3	0.9000	1.2490
1	control	4	0.8000	1.1071
1	control	5	1.0000	1.4120
1	control	6	0.8000	1.1071
1	control	7	0.8000	1.1071
1	control	8	0.9000	1.2490
2	6%	1	0.7000	0.9912
2	6%	2	0.7000	0.9912
2	6%	3	0.8000	1.1071
2	6%	4	0.9000	1.2490
2	6%	5	0.9000	1.2490
2	6%	6	0.7000	0.9912
2	6%	7	0.7000	0.9912
2	6%	8	0.8000	1.1071
3	12%	1	0.8000	1.1071
3	12%	2	0.5000	0.7854
3	12%	3	0.4000	0.6847
3	12%	4	0.7000	0.9912
3	12%	5	0.5000	0.7854
3	12%	6	0.6000	0.8861
3	12%	7	0.7000	0.9912
3	12%	8	0.7000	0.9912
4	25%	1	0.2000	0.4636
4	25%	2	0.1000	0.3218
4	25%	3	0.1000	0.3218
4	25%	4	0.1000	0.3218
4	25%	5	0.1000	0.3218
4	25%	6	0.0000	0.1588
4	25%	7	0.0000	0.1588
4	25%	8	0.0000	0.1588
5	50%	1	0.3000	0.5796
5	50%	2	0.1000	0.3218
5	50%	3	0.0000	0.1588
5	50%	4	0.0000	0.1588
5	50%	5	0.0000	0.1588
5	50%	6	0.0000	0.1588
5	50%	7	0.0000	0.1588
5	50%	8	0.0000	0.1588
6	ACTR	1	0.0000	0.1588
6	ACTR	2	0.0000	0.1588
6	ACTR	3	0.0000	0.1588
6	ACTR	4	0.0000	0.1588
6	ACTR	5	0.0000	0.1588
6	ACTR	6	0.0000	0.1588
6	ACTR	7	0.0000	0.1588
6	ACTR	8	0.0000	0.1588
7	REM-1	1	0.7000	0.9912

Freshwater Acute Test

American Aquatic Testing, Inc.

Job #: SRT #1

Start Date: 2-24-98

Species: C. tentans

Start Time: 200pm

Dilution Water: EPA Mod. Hard

Test Type: 48hr. SNR

Concentration ppm	Rep.	Dissolved Oxygen(mg/L)			Temperature (C)			Live Count		
		0 hr.	24 hr.	48 hr.	0 hr.	24 hr.	48 hr.	0 hr.	24 hr.	48 hr.
Control	A	8.2	7.9	7.5	23.0	21.5	22.0	10	10	9'
	B	8.2	7.9	7.4	23.0	21.5	22.0	10	10	9'
125	A	8.2	7.9	7.5	23.0	21.5	22.0	10	10	9'
	B	8.2	7.9	7.5	23.0	21.5	22.0	10	9'	9
250	A	8.2	8.1	7.6	23.0	21.5	22.0	10	10	10
	B	8.2	8.1	7.5	23.0	21.5	22.0	10	10	8 ²
500	A	8.2	8.2	7.6	23.0	21.5	22.0	10	9'	9
	B	8.2	8.2	7.6	23.0	21.5	22.0	10	9'	8'
1000	A	8.2	8.2	7.7	23.0	21.5	22.0	10	6 ⁴	5'
	B	8.2	8.2	7.8	23.0	21.5	22.0	10	4 ⁶	2 ²
2000	A	8.2	8.1	7.9	23.0	21.5	22.0	10	19	1
	B	8.2	8.1	7.9	23.0	21.5	22.0	10	3 ⁷	2'
Initials		TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP
Date		2/24	2/25	2/26	2/24	2/25	2/26	2/24	2/25	2/26

Concentration ppm	Alkalinity (mg/L)			Hardness (mg/L)			Chlorine (mg/L)
	0 hr.	24 hr.	48 hr.	0 hr.	24 hr.	48 hr.	Sample 1
Control	90			90			
1000 2000	90			90			
Initials	TAP			TAP			
Date	2/24			2/24			

Concentration ppm	pH (std units)			Conductivity (umhos)		
	0 hr.	24 hr.	48 hr.	0 hr.	24 hr.	48 hr.
Control	7.1	6.8	7.0	305	305	315
125	7.1	6.9	6.9	550	550	550
250	7.2	7.1	7.0	800	800	800
500	7.3	7.3	7.2	1300	1300	1300
1000	7.4	7.5	7.4	2300	2300	2300
2000	7.6	7.6	7.6	4100	4100	4100
Initials	TAP	TAP	TAP	TAP	TAP	TAP
Date	2/24	2/25	2/26	2/24	2/25	2/26

Observations:

48HR LC₅₀ 770.8ppm

KCCT307#01

C. tentans SRT # 01 48 hr LC50 02/24/98
File: kcctsrt#.01 Transform: NO TRANSFORM

Spearman - Karber Estimate of LC50

Estimated LC50 = 770.8333 (Variance = 28950.078167)
95% confidence interval: (437.351, 1104.316)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
2	125 ppm	0.100	0.100	125.00
3	250 ppm	0.100	0.100	250.00
4	500 ppm	0.150	0.150	500.00
5	1000 ppm	0.650	0.650	1000.00
6	2000 ppm	0.850	0.850	2000.00

Client/Toxicant: 48
 Job Number: 02-01
 Species: C. tentans

Beginning Date & Time: 2-20-98 430pm
 Ending Date & Time: 3-6-98 300pm

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

Conc.	Rep.	Day														Day 14	
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	Observ	Final Count
Control	A	N	N	N	N	N	N	N	IF	N	N	N	N	N	N	1P	10
	B	N	N	N	N	N	N	N	N	N	N	N	N	N	IF	2P	8
	C	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9
	D	N	N	N	N	N	N	N	N	N	N	N	N	N	N	1P	8
	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	1P	8
	F	N	N	N	N	N	N	N	N	N	N	N	N	N	N ^②	N	9 ^③
	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	1P	8
	H	N	N	N	N	N	N	N	N	N	N	N	N	N	N	1P	8
Reference	A	N	N	N	N	N	IF	N	N	N	N	N	N	N	N	1P	7
	B	N	N	N	N	N	N	IF	N	N	N	N	N	N	N	N	8
	C	N	N	N	N	N	N	N	N	N	N	N	N	N	IF	1P	8
	D	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9
	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	7
	F	N	N	N	N	N	N	N	N	N	N	N	N	N	N	1P	9
	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	8
	H	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	8
6%	A	N	N	N	^① IF	IF	N	N	N	N	N	N	N	N	N	1P	9
	B	N	N	N	N	N	IF	N	N	N	N	N	N	N	N	N	7
	C	N	N	IF	2F	IF	N	IF	N	N	N	N	N	N	N	N	7
	D	N	N	N	N	N	N	N	IF	N	N	N	N	N	N	N	8
	E	N	N	2F	IF	N	N	N	N	N	N	N	N	N	N	N	9
	F	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9
	G	N	N	2F	IF	IF	IF	N	N	N	N	N	N	N	N	1P	7
	H	N	N	N	N	N	N	ID	N	N	N	N	N	N	N	N	7
Initials		TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP
Date		2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/6

Key: D=dead, W=on water surface, M=swimming, F=on sediment surface, P=pupae, N=no observations
 Comments: ① IF-TRP 2/23 ② 1P-TRP 3/5 ③ 10 TRP 3/6

Client/Toxicant: 48
 Job Number: 02-01
 Species: C. tentans

Beginning Date & Time: 2-20-98 430pm
 Ending Date & Time: 3-6-98 300pm

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

Conc.	Rep.	Day														Day 14	
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	Observ	Final Count
12%	A	N	1F	N	N	1F	N	N	N	N	N	N	N	N	N	N	8
	B	N	2F	1F	4F	3F	1D4F	1F	2F	N	N	N	N	N	N	N	5
	C	N	N	N	3F	2F	2F	N	1F	N	N	N	N	N	N	N	4
	D	N	2F	N	1F	1F	N	N	N	N	N	N	N	N	N	N	7
	E	N	N	1F	N	1F	N	N	N	N	N	N	N	N	N	N	5
	F	N	2F	2F	1D1F	1F	1F	N	N	1F	N	N	N	N	N	1P	6
	G	N	N	N	1F	3P	3F	N	2F	N	N	N	N	N	N	N	7
	H	N	1F	N	2F	1D	1F	N	N	N	N	N	N	N	N	N	7
25%	A	N	6F	6F	4F	3F	1D4F	N	1F	N	1F	N	N	N	N	1P	7
	B	N	7F	5F	7F	4F	5F	2D4F	4F	1D3F	3F	4F	1F	N	N	1D	0
	C	N	5F	6F	10F	8F	9F	2D5F	2D3F	1D1F	1D1F	N	N	N	N	N	2
	D	N	5F	4F	4F	1D4F	4F	1D2F	2F	1F	1F	N	1D	N	N	N	0
	E	N	4F	2F	4F	2F	1F	2F	1F	1D1F	N	1F	N	N	N	N	1
	F	N	1W, 2F	4F	3F	3F	4F	1D2F	2F	1D	N	N	N	N	N	N	0
	G	N	3F	6F	7F	2F	1D5F	N	1D2F	1D1F	N	N	N	N	1F	N	1
	H	N	7F	5F	9F	4F	6F	3F	4F	3F	N	N	N	N	N	N	1
50%	A	N	6F	4F	5F	4F	2D3F	2F	N	N	N	N	N	N	N	N	0
	B	N	7F	6F	7F	5F	5F	2F	2F	3F	4F	4F	3F	N	N	N	3
	C	N	4F	5F	6F	4F	2D2F	1D1F	1F	N	N	N	N	N	N	N	0
	D	N	6F	4F	5F	1D6F	2D3F	1F	1F	N	N	N	N	N	N	N	0
	E	N	5F	3F	1F	2F	1D	N	N	N	N	N	N	N	N	N	0
	F	N	6F	4F	5F	3F	2D2F	1F	1F	1F	1D	N	N	N	N	N	0
	G	N	6F	6F	4F	3F	2D	N	N	N	N	N	N	N	N	N	0
	H	N	5F	5F	5F	4F	4F	4D1F	1F	1F	1F	1F	1F	N	N	N	0
Initials	TAP	GA	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP
Date	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/6	3/6

Key: D=dead, W=on water surface, M=swimming, F=on sediment surface, P=pupae, N=no observations

Comments:

* NEARLY ALL CHAMBERS OF 12, 25 & 50% HAVE SURFNT SWIM ON SURFACE 02/21/98 GA

Client/Toxicant: 48
 Job Number: 02-01
 Species: C. tentans

Beginning Date & Time: 2-20-98 430pm
 Ending Date & Time: 3-6-98 300pm

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

Conc.	Rep	Day													Day 14		
		0	1*	2	3	4	5	6	7	8	9	10	11	12	13	Observ	Final Count
ACTR	A	N	5F	2F	202F	1F	1D	N	N	N	N	N	N	N	N	N	0
	B	N	3F	3F	4F	2D	1D	N	N	N	N	N	N	N	N	N	0
	C	N	4F	4F	103F	1F	N	N	N	N	N	N	N	N	N	N	0
	D	N	4F	5F	202F	101F	1D1F	N	N	N	N	N	N	N	N	N	0
	E	N	4F	5F	105F	301F	2D	N	N	N	N	N	N	N	N	N	0
	F	N	7F	5F	4F	201F	1D	N	N	N	N	N	N	N	N	N	0
	G	N	4F	5F	5F	301F	4D1F	1F	1D	N	N	N	N	N	N	N	0
	H	N	5F	2F	2D	N	N	N	N	N	N	N	N	N	N	N	0
REM-1	A	N	1F	N	1F	N	1F	1D	N	N	1F	2F	N	N	N	1F	7
	B	N	N	2F	N	N	N	N	N	N	N	N	N	N	N	N	10
	C	N	1F	1F	1F	1F	1F	N	2F	N	N	N	N	N	N	N	8
	D	N	2F	2F	1F	1F	1F	N	N	N	N	N	N	N	N	N	8
	E	N	2F	N	3F	1F	N	1F	N	N	N	N	1D	N	N	N	7
	F	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9
	G	N	1F	1F	2F	1D	N	N	N	N	N	N	N	N	N	N	7
	H	N	1F	1F	N	1F	N	N	N	N	N	1F	N	N	N	N	8
REM-2	A	N	6F	3F	3P	2F	1D2F	1F	N	1F	1F	N	N	N	N	N	2
	B	N	6F	4F	3F	1F	1D1F	N	1F	10/2F	1F	1F	1F	N	N	N	2
	C	N	6F	5F	6F	104F	3F	1D2F	N	1F	1F	1F	N	1F	N	N	2
	D	N	7F	4F	4F	2F	1F	N	N	1F	N	N	N	N	N	N	3
	E	N	6F	2F	3F	1F	1D1F	1D1F	1F	1D	N	N	N	N	N	N	2
	F	N	7F	3F	3F	3F	4F	N	1F	1F	1F	1D	N	N	N	N	1
	G	N	8F	6F	3F	2F	4D	2F	2F	1F	1D	N	N	N	N	N	1
	H	N	10F	6F	5F	1D3F	4D1F	1D1F	N	N	N	N	N	N	N	N	0
Initials	TAP	C	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP
Date	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/6	3/6
Key: D=dead W=on water surface M=																	

Key: D=dead, W=on water surface, M=swimming, F=on sediment surface, P=pupae, N=no observations

Comments:

* NEARLY ALL CHARACTERS OF ACTR, REM-1 + REM-2 HAVE SURVIVED SCREEN ON SURFACE 2/22/98
 @ 1D 2F - TAP 2/23

Client/Toxicant: 48
 Job Number: 02-01
 Species: C. tentans

Beginning Date & Time: 2-20-98 430pm
 Ending Date & Time: 3-6-98 300pm

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Physical/Chemical Parameters

		Day														
Parameter	Concentration	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
TEMP (C)	Control	22.0	22.5	23.0	22.0	22.0	22.5	23.0	23.0	23.0	22.0	22.5	23.0	22.0	22.0	22.0
	Reference	22.0	22.5	23.0	21.0	22.0	22.5	23.0	23.0	23.0	22.0	22.5	23.0	22.0	22.0	21.0
	6%	22.0	22.5	23.0	22.0	22.0	22.5	23.0	23.0	23.0	22.0	22.5	23.0	22.0	22.0	22.0
	12%	22.0	22.5	23.0	22.0	22.0	22.5	23.0	23.0	23.0	22.0	22.5	23.0	22.0	22.0	22.0
	25%	22.0	22.5	23.0	22.0	22.0	22.5	23.0	23.0	23.0	22.0	22.5	23.0	22.0	22.0	22.0
	50%	22.0	22.5	23.0	22.0	22.0	22.5	23.0	23.0	23.0	22.0	22.5	23.0	22.0	22.0	22.0
	ACTR	22.0	22.5	23.0	22.0	22.0	22.5	23.0	23.0	23.0	22.0	22.5	23.0	22.0	22.0	22.0
	REM-1	22.0	22.5	23.0	22.0	22.0	22.5	23.0	23.0	23.0	22.0	22.5	23.0	22.0	22.0	22.0
REM-2	22.0	22.5	23.0	22.0	22.0	22.5	23.0	23.0	23.0	22.0	22.5	23.0	22.0	22.0	22.0	
Dissolved Oxygen (mg/L)	Control	8.5	6.9	7.1	6.0	5.9	5.9	6.0	6.4	6.5	5.8	6.0	5.5	5.6	5.6	5.8
	Reference	8.5	7.2	7.4	6.5	6.6	6.7	6.4	7.1	7.0	6.6	6.6	5.9	6.5	6.3	6.6
	6%	8.3	7.2	7.4	6.2	6.4	6.3	6.4	6.9	6.8	6.3	6.3	5.5	6.3	6.2	6.4
	12%	8.5	7.3	7.2	6.5	6.3	6.2	6.5	6.5	6.6	6.4	6.3	5.4	6.3	6.2	6.4
	25%	8.2	7.3	7.3	6.0	6.1	6.1	6.4	6.7	6.5	6.6	6.3	5.5	6.3	6.3	6.4
	50%	7.3	7.1	7.0	6.1	6.5	6.4	6.5	6.8	6.7	6.6	6.2	5.6	6.4	5.9	6.0
	ACTR	8.0	7.4	7.3	6.3	6.4	6.2	6.8	6.9	6.8	6.7	6.2	5.9	6.7	6.4	6.5
	REM-1	8.5	7.5	7.6	6.9	7.0	6.9	6.8	7.0	7.0	6.4	6.2	5.5	6.2	6.2	6.1
	REM-2	8.2	7.3	7.2	6.6	6.2	6.2	6.5	6.8	6.8	6.4	6.1	5.5	6.3	6.5	6.3
	Initials	TRP	CW	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP	TRP
Date	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	

Concentration	Cond. (umhos)		Alkalinity (mg/L)		Hardness (mg/L)		Ammonia (mg/L)		pH	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Control	295	320	70	80	80	100	0.0	0.0	6.9	7.1
Reference	300	320	70	80	90	100	0.0	0.0	6.9	7.0
6%	305	320	80	80	90	100	0.0	0.0	7.0	7.2
12%	300	330	80	90	90	100	0.0	0.0	7.0	7.2
25%	305	335	90	90	90	100	0.0	0.0	7.0	7.3
50%	305	330	80	80	90	110	0.0	0.0	7.0	7.3
ACTR	300	325	80	80	90	100	0.0	0.0	7.0	7.2
REM-1	320	325	90	80	90	90	0.2	0.0	6.9	7.3
REM-2	310	340	80	80	100	110	0.1	0.0	7.0	7.2
Initials	TRP	C	C	TRP	C	C	C	C	TRP	C
Date	2/20	2/26	02/20	03/06	02/20	03/06	02/20	03/06	2/20	03/06

Comments:



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region 4

**Science and Ecosystem Support Division
980 College Station Road
Athens, Georgia 30605-2720**

MEMORANDUM

Date: 03/23/98

Subject: Results of METALS INORGANIC Chemistry Section Sample Analysis
98-0241 Tennessee Products
Chattanooga, TN

Soils / Sediments

From: Mike Wasko

To: Alan Auwarter

CC: SESD/EAB/EES

Thru: Jenny Scifres
Chief, INORGANIC Chemistry Section

Attached are the results of analysis of samples collected as part of the subject project. If you have any questions, please contact me.

The RPD (relative percent difference) of some analytes were outside of acceptance windows on the initial digest of sediment matrix samples. Sediment matrix samples were redigested and reanalyzed. Additional elements were outside of control limits on the second digest of the samples indicating matrix/sample inconsistencies. Results of both digests were averaged for reporting. A flag of "A" (average) was appended to those results where the relative percent difference between the two digestions was greater than 20.

ATTACHMENT



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

Science and Ecosystem Support Division
980 College Station Road
Athens, Georgia 30605-2720

April 30, 1998

Mark Sprenger
U.S. EPA, Environmental Response Branch
Woodbridge Ave.
Raritan Depot Bldg. 18
Edison, NJ 08837

Dear Mark:

Enclosed are the analytical results that I have accumulated to date for the Chattanooga Creek project. The results are complete for soil and sediment samples, and include a separate data package for:

- inorganics,
- volatile organics,
- extractable organics, and
- pesticides and PCBs.

Included in separate data packages for the earthworm testing are analytical results for:

- pesticides and PCBs,
- percent lipids, and
- an equipment rinse blank.

Also enclosed is the original report of the earthworm toxicity test conducted by our ESAT Biological Assistance Team.

I am awaiting the concluding analytical results for the earthworm test, namely the inorganics. As soon as they are available, I will forward them on to you. Unhappily, there had been an equipment problem in the inorganics lab, projects backed up a bit, but things are back on line, and this project is third in line for analysis at this time. I expect to see results in approximately two weeks. I hope that will not create too much of a hardship to the completion of the site report. Should you wish to further explore earthworm test results, please feel free to contact Dr. Jim Maudsley directly at (706)355-8682.

I hope all is well with you, and that other aspects of this project are coming together.

Sincerely,

A handwritten signature in cursive script, appearing to read "Alan".

Alan Auwarter

xc with data: Nestor Young; xc without data: Lynn Wellman, Jim Maudsley

PARTICLE SIZE ANALYSIS

Technician's name:

Brian Holderness

Date:

02/27/98

Site name:

Tennessee Products

Sample No.:

*0015

Sample Data

Mass of sample split on No. 10 sieve (g):

469.26

Mass retained on No. 10 sieve (g):

1.95

Mass passing No. 10 sieve (g):

467.31

Percent passing No. 10 sieve (g):

99.58

Mass used in Hydrometer test (g):

102.41

Specific gravity of soil:

2.65

Correction factor:

1

Corrected mass of soil used
in hydrometer test (g):

102.41

Hygroscopic Moisture

Wet mass of hygroscopic test sample (g):

15

Oven-dry mass of test sample (g):

14.8

Percent hygroscopic moisture:

1.33

Corrected mass of soil
used in hydrometer test (g):

101.04

Hydrometer Test

Hydrometer type:

Hydrometer correction:

0.002

Average temperature (C):

20

Temperature correction factor:

0

Total Hydrometer correction:

0.002

Values

K: 0.01365
W: 101.47
F: 0.42

Results: *0015

Sieve Analysis

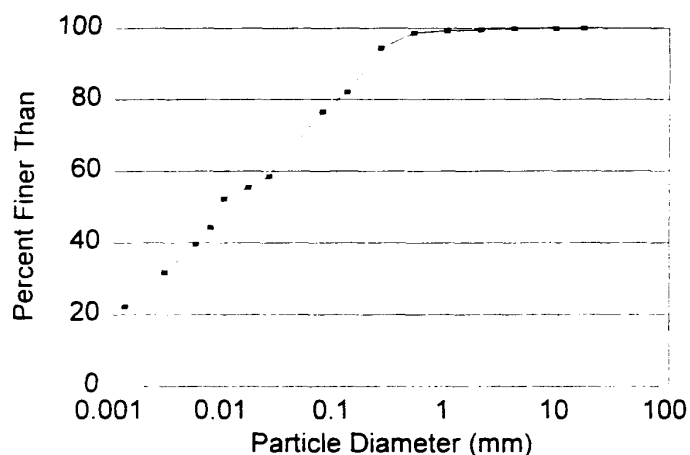
Sieve Size (mm)	Mass Retained (g)	Hygroscopic Corrected Mass Retained (g)	Mass Retained Corrected for F (g)	Mass Passing (g)	Percent Finer Than
16	0.00	0.00	0.00	101.47	100.00
9.5	0.00	0.00	0.00	101.47	100.00
4	0.00	0.00	0.00	101.47	100.00
2	1.96	1.93	0.42	101.05	99.59

Hydrometer Test Analysis

Time, T (Minutes)	Hydrometer Reading	Corrected Reading	Length, L (cm)	Diameter (mm)	Percent Suspended
2	1.039	1.037	6.51	0.0246	58.57
5	1.037	1.035	7.04	0.0162	55.40
15	1.035	1.033	7.57	0.0097	52.23
30	1.030	1.028	8.89	0.0074	44.32
60	1.027	1.025	9.68	0.0055	39.57
250	1.022	1.02	11.00	0.0029	31.66
1440	1.016	1.014	12.59	0.0013	22.16

Sieve Analysis <No.10

Size (mm)	Mass Retained (g)	Mass Passing (g)	Percent Finer Than
1	0.30	100.74	99.29
0.5	0.60	100.14	98.70
0.25	4.27	95.87	94.49
0.125	12.55	83.32	82.12
0.075	5.61	77.71	76.59
TOTAL	23.33		



ASTM Grain Size	Particle Dia. (mm)	Percent Finer
Fine Gravel	16	100.00
Gravel	9.5	100.00
Course Sand	4	100.00
Sand	2	99.59
Medium Sand	1	99.29
Fine Sand	0.5	98.70
	0.25	94.49
	0.125	82.12
	0.075	76.59
	0.0246	58.57
	0.0162	55.40
Silt	0.0097	52.23
	0.0074	44.32
	0.0055	39.57
	0.0029	31.66
Clay	0.0013	22.16

PARTICLE SIZE ANALYSIS

Technician's name:

Brian Holderness

Date:

02/27/98

Site name:

Tennessee Products

Sample No.:

*0014

Sample Data

Mass of sample split on No. 10 sieve (g):

552.54

Mass retained on No. 10 sieve (g):

0

Mass passing No. 10 sieve (g):

552.54

Percent passing No. 10 sieve (g):

100.00

Mass used in Hydrometer test (g):

102.12

Specific gravity of soil:

2.65

Correction factor:

1

Corrected mass of soil used

in hydrometer test (g):

102.12

Hygroscopic Moisture

Wet mass of hygroscopic test sample (g):

15

Oven-dry mass of test sample (g):

14.8

Percent hygroscopic moisture:

1.33

Corrected mass of soil

used in hydrometer test (g):

100.76

Hydrometer Test

Hydrometer type:

Hydrometer correction:

0.002

Average temperature (C):

20

Temperature correction factor:

0

Total Hydrometer correction:

0.002

Values

K: 0.01365
W: 100.76
F: 0.00

Results: *0014

Sieve Analysis

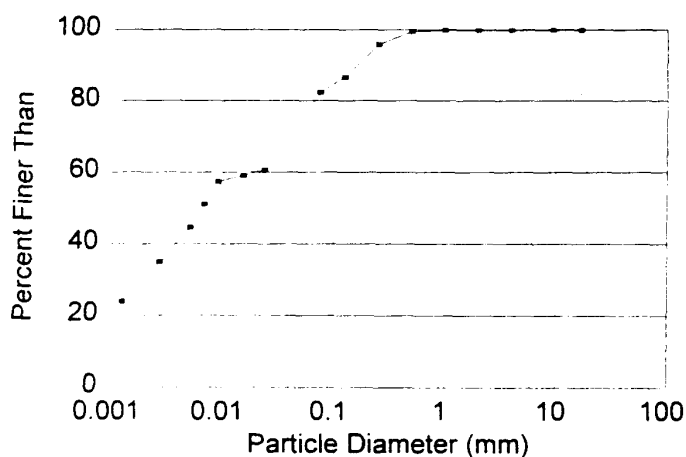
Sieve Size (mm)	Mass Retained (g)	Hygroscopic Corrected Mass Retained (g)	Mass Retained Corrected for F (g)	Mass Passing (g)	Percent Finer Than
16	0.00	0.00	0.00	100.76	100.00
9.5	0.00	0.00	0.00	100.76	100.00
4	0.00	0.00	0.00	100.76	100.00
2	0.00	0.00	0.00	100.76	100.00

Hydrometer Test Analysis

Time, T (Minutes)	Hydrometer Reading	Corrected Reading	Length, L (cm)	Diameter (mm)	Percent Suspended
2	1.040	1.038	6.24	0.0241	60.57
5	1.039	1.037	6.51	0.0156	58.98
15	1.038	1.036	6.77	0.0092	57.38
30	1.034	1.032	7.83	0.0070	51.01
60	1.030	1.028	8.89	0.0053	44.63
250	1.024	1.022	10.48	0.0028	35.07
1440	1.017	1.015	12.33	0.0013	23.91

Sieve Analysis <No.10

Size (mm)	Mass Retained (g)	Mass Passing (g)	Percent Finer Than
1	0.07	100.69	99.93
0.5	0.40	100.29	99.53
0.25	3.65	96.64	95.91
0.125	9.45	87.19	86.53
0.075	4.24	82.95	82.32
TOTAL	17.81		



ASTM Grain Size	Particle Dia. (mm)	Percent Finer
Fine Gravel	16	100.00
Gravel	9.5	100.00
Course Sand	4	100.00
Sand	2	100.00
Medium Sand	1	99.93
Fine Sand	0.5	99.53
	0.25	95.91
	0.125	86.53
	0.075	82.32
	0.0241	60.57
	0.0156	58.98
Silt	0.0092	57.38
	0.0070	51.01
	0.0053	44.63
	0.0028	35.07
Clay	0.0013	23.91

Results: *0013

Sieve Analysis

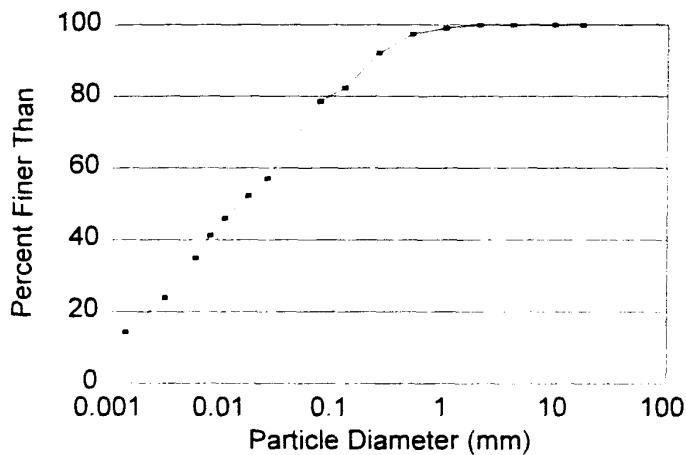
Sieve Size (mm)	Mass Retained (g)	Hygroscopic Corrected Mass Retained (g)	Mass Retained Corrected for F (g)	Mass Passing (g)	Percent Finer Than
16	0.00	0.00	0.00	101.25	100.00
9.5	0.00	0.00	0.00	101.25	100.00
4	0.00	0.00	0.00	101.25	100.00
2	0.00	0.00	0.00	101.25	100.00

Hydrometer Test Analysis

Time, T (Minutes)	Hydrometer Reading	Corrected Reading	Length, L (cm)	Diameter (mm)	Percent Suspended
2	1.038	1.036	6.77	0.0251	57.10
5	1.035	1.033	7.57	0.0168	52.34
15	1.031	1.029	8.62	0.0103	46.00
30	1.028	1.026	9.42	0.0076	41.24
60	1.024	1.022	10.48	0.0057	34.90
250	1.017	1.015	12.33	0.0030	23.79
1440	1.011	1.009	13.91	0.0013	14.28

Sieve Analysis <No.10

Size (mm)	Mass Retained (g)	Mass Passing (g)	Percent Finer Than
1	0.94	100.31	99.07
0.5	1.76	98.55	97.33
0.25	5.27	93.28	92.13
0.125	9.86	83.42	82.39
0.075	3.81	79.61	78.63
TOTAL	21.64		



ASTM Grain Size	Particle Dia. (mm)	Percent Finer
Fine Gravel	16	100.00
Gravel	9.5	100.00
Course Sand	4	100.00
Sand	2	100.00
Medium Sand	1	99.07
Fine Sand	0.5	97.33
	0.25	92.13
	0.125	82.39
	0.075	78.63
	0.0251	57.10
	0.0168	52.34
Silt	0.0103	46.00
	0.0076	41.24
	0.0057	34.90
	0.0030	23.79
Clay	0.0013	14.28

PARTICLE SIZE ANALYSIS

Technician's name: Brian Holderness
Date: 02/27/98
Site name: Tennessee Products
Sample No.: *0013

Sample Data

Mass of sample split on No. 10 sieve (g): 346.82
Mass retained on No. 10 sieve (g): 0
Mass passing No. 10 sieve (g): 346.82
Percent passing No. 10 sieve (g): 100.00

Mass used in Hydrometer test (g): 102.62
Specific gravity of soil: 2.65
Correction factor: 1
Corrected mass of soil used
in hydrometer test (g): 102.62

Hygroscopic Moisture

Wet mass of hygroscopic test sample (g): 15
Oven-dry mass of test sample (g): 14.8
Percent hygroscopic moisture: 1.33
Corrected mass of soil
used in hydrometer test (g): 101.25

Hydrometer Test

Hydrometer type:
Hydrometer correction: 0.002
Average temperature (C): 20
Temperature correction factor: 0
Total Hydrometer correction: 0.002

Values

K: 0.01365
W: 101.25
F: 0.00

Results: 0012

Sieve Analysis

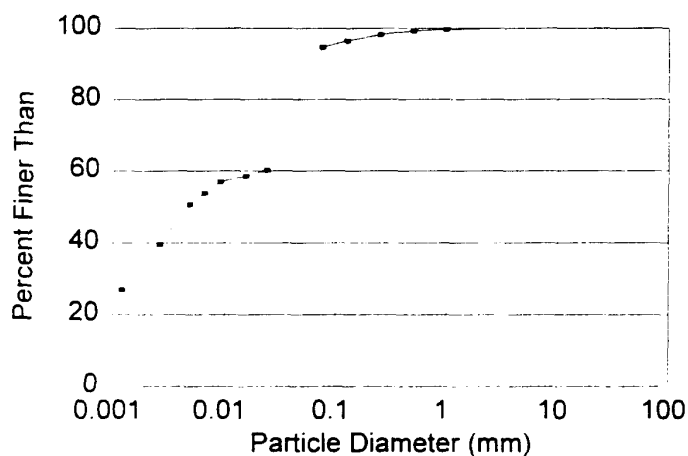
Sieve Size (mm)	Mass Retained (g)	Hygroscopic Corrected Mass Retained (g)	Mass Retained Corrected for F (g)	Mass Passing (g)	Percent Finer Than
16	0.00	0.00	0.00	101.44	100.00
9.5	0.00	0.00	0.00	101.44	100.00
4	0.00	0.00	0.00	101.44	100.00
2	0.00	0.00	0.00	101.44	100.00

Hydrometer Test Analysis

Time, T (Minutes)	Hydrometer Reading	Corrected Reading	Length, L (cm)	Diameter (mm)	Percent Suspended
2	1.040	1.038	6.24	0.0241	60.16
5	1.039	1.037	6.51	0.0156	58.58
15	1.038	1.036	6.77	0.0092	57.00
30	1.036	1.034	7.30	0.0067	53.83
60	1.034	1.032	7.83	0.0049	50.66
250	1.027	1.025	9.68	0.0027	39.58
1440	1.019	1.017	11.80	0.0012	26.92

Sieve Analysis <No. 10

Size (mm)	Mass Retained (g)	Mass Passing (g)	Percent Finer Than
1	0.29	101.15	99.71
0.5	0.43	100.72	99.29
0.25	1.04	99.68	98.26
0.125	1.84	97.84	96.45
0.075	1.76	96.08	94.72
TOTAL	5.36		



ASTM Grain Size	Particle Dia. (mm)	Percent Finer
Fine Gravel	16	100.00
Gravel	9.5	100.00
Course Sand	4	100.00
Sand	2	100.00
Medium Sand	1	99.71
Sand	0.5	99.29
Fine Sand	0.25	98.26
	0.125	96.45
	0.075	94.72
	0.0241	60.16
	0.0156	58.58
Silt	0.0092	57.00
	0.0067	53.83
	0.0049	50.66
	0.0027	39.58
Clay	0.0012	26.92

PARTICLE SIZE ANALYSIS

Technician's name:

Brian Holderness

Date:

02/27/98

Site name:

Tennessee Products

Sample No.:

*0012

Sample Data

Mass of sample split on No. 10 sieve (g):

444.72

Mass retained on No. 10 sieve (g):

0

Mass passing No. 10 sieve (g):

444.72

Percent passing No. 10 sieve (g):

100.00

Mass used in Hydrometer test (g):

102.81

Specific gravity of soil:

2.65

Correction factor:

1

Corrected mass of soil used

in hydrometer test (g):

102.81

Hygroscopic Moisture

Wet mass of hygroscopic test sample (g):

15

Oven-dry mass of test sample (g):

14.8

Percent hygroscopic moisture:

1.33

Corrected mass of soil

used in hydrometer test (g):

101.44

Hydrometer Test

Hydrometer type:

Hydrometer correction:

0.002

Average temperature (C):

20

Temperature correction factor:

0

Total Hydrometer correction:

0.002

Values

K:

0.01365

W:

101.44

F:

0.00

Results: *0011

Sieve Analysis

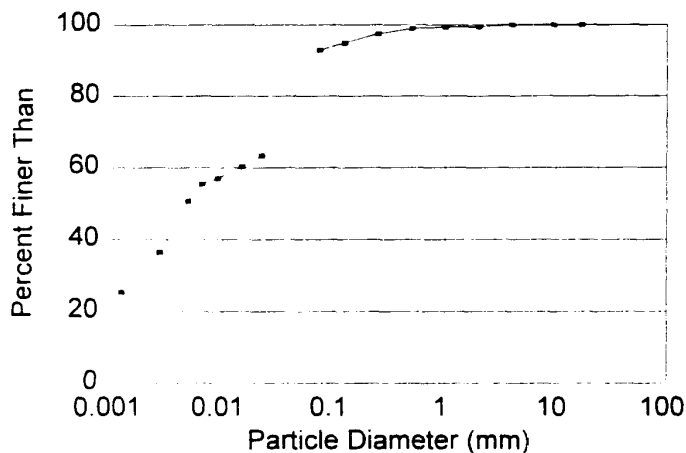
Sieve Size (mm)	Mass Retained (g)	Hygroscopic Corrected Mass Retained (g)	Mass Retained Corrected for F (g)	Mass Passing (g)	Percent Finer Than
16	0.00	0.00	0.00	101.43	100.00
9.5	0.00	0.00	0.00	101.43	100.00
4	0.00	0.00	0.00	101.43	100.00
2	1.29	1.27	0.47	100.96	99.54

Hydrometer Test Analysis

Time, T (Minutes)	Hydrometer Reading	Corrected Reading	Length, L (cm)	Diameter (mm)	Percent Suspended
2	1.042	1.04	5.71	0.0231	63.33
5	1.040	1.038	6.24	0.0153	60.17
15	1.038	1.036	6.77	0.0092	57.00
30	1.037	1.035	7.04	0.0066	55.42
60	1.034	1.032	7.83	0.0049	50.67
250	1.025	1.023	10.21	0.0028	36.42
1440	1.018	1.016	12.06	0.0012	25.33

Sieve Analysis <No.10

Size (mm)	Mass Retained (g)	Mass Passing (g)	Percent Finer Than
1	0.19	100.86	99.44
0.5	0.42	100.44	99.02
0.25	1.52	98.92	97.53
0.125	2.60	96.32	94.96
0.075	2.01	94.31	92.98
TOTAL	6.74		



ASTM Grain Size	Particle Dia. (mm)	Percent Finer
Fine Gravel	16	100.00
Gravel	9.5	100.00
Course Sand	4	100.00
Sand	2	99.54
Medium Sand	1	99.44
Fine Sand	0.5	99.02
	0.25	97.53
	0.125	94.96
	0.075	92.98
	0.0231	63.33
	0.0153	60.17
Silt	0.0092	57.00
	0.0066	55.42
	0.0049	50.67
	0.0028	36.42
Clay	0.0012	25.33

PARTICLE SIZE ANALYSIS

Technician's name:

Brian Holderness

Date:

02/27/98

Site name:

Tennessee Products

Sample No.:

*0011

Sample Data

Mass of sample split on No. 10 sieve (g):

275

Mass retained on No. 10 sieve (g):

1.03

Mass passing No. 10 sieve (g):

273.97

Percent passing No. 10 sieve (g):

99.63

Mass used in Hydrometer test (g):

102.42

Specific gravity of soil:

2.65

Correction factor:

1

Corrected mass of soil used

in hydrometer test (g):

102.42

Hygroscopic Moisture

Wet mass of hygroscopic test sample (g):

15

Oven-dry mass of test sample (g):

14.8

Percent hygroscopic moisture:

1.33

Corrected mass of soil

used in hydrometer test (g):

101.05

Hydrometer Test

Hydrometer type:

Hydrometer correction:

0.002

Average temperature (C):

20

Temperature correction factor:

0

Total Hydrometer correction:

0.002

Values

K:

0.01365

W:

101.43

F:

0.38

Results: *0010

Sieve Analysis

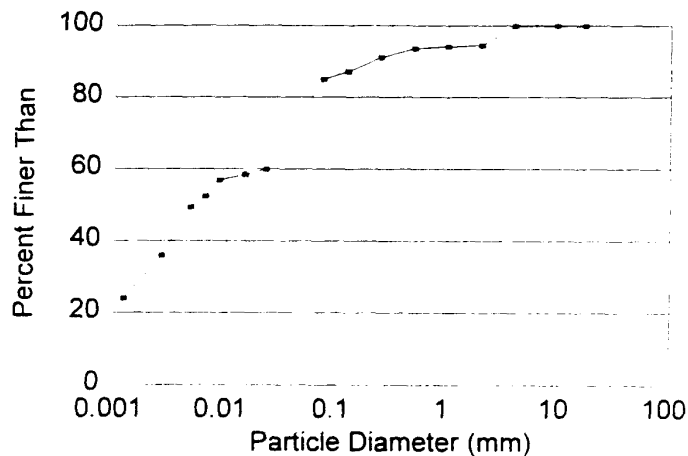
Sieve Size (mm)	Mass Retained (g)	Hygroscopic Corrected Mass Retained (g)	Mass Retained Corrected for F (g)	Mass Passing (g)	Percent Finer Than
16	0.00	0.00	0.00	107.25	100.00
9.5	0.00	0.00	0.00	107.25	100.00
4	0.00	0.00	0.00	107.25	100.00
2	22.87	22.57	5.92	101.33	94.48

Hydrometer Test Analysis

Time, T (Minutes)	Hydrometer Reading	Corrected Reading	Length, L (cm)	Diameter (mm)	Percent Suspended
2	1.042	1.04	5.71	0.0231	59.90
5	1.041	1.039	5.98	0.0149	58.40
15	1.040	1.038	6.24	0.0088	56.91
30	1.037	1.035	7.04	0.0066	52.41
60	1.035	1.033	7.57	0.0048	49.42
250	1.026	1.024	9.95	0.0027	35.94
1440	1.018	1.016	12.06	0.0012	23.96

Sieve Analysis <No.10

Size (mm)	Mass Retained (g)	Mass Passing (g)	Percent Finer Than
1	0.33	100.90	94.08
0.5	0.59	100.31	93.53
0.25	2.72	97.59	91.00
0.125	4.24	93.35	87.04
0.075	2.28	91.07	84.92
TOTAL	10.16		



ASTM Grain Size	Particle Dia. (mm)	Percent Finer
Fine Gravel	16	100.00
Gravel	9.5	100.00
Course Sand	4	100.00
Sand	2	94.48
Medium Sand	1	94.08
Fine Sand	0.5	93.53
	0.25	91.00
	0.125	87.04
	0.075	84.92
	0.0231	59.90
	0.0149	58.40
Silt	0.0088	56.91
	0.0066	52.41
	0.0048	49.42
	0.0027	35.94
Clay	0.0012	23.96

PARTICLE SIZE ANALYSIS

Technician's name: Brian Holderness
Date: 02/27/98
Site name: Tennessee Products
Sample No.: *0010

Sample Data

Mass of sample split on No. 10 sieve (g):	408.98
Mass retained on No. 10 sieve (g):	22.94
Mass passing No. 10 sieve (g):	386.04
Percent passing No. 10 sieve (g):	94.39

Mass used in Hydrometer test (g):	102.6
Specific gravity of soil:	2.65
Correction factor:	1
Corrected mass of soil used in hydrometer test (g):	102.6

Hygroscopic Moisture

Wet mass of hygroscopic test sample (g):	15
Oven-dry mass of test sample (g):	14.8
Percent hygroscopic moisture:	1.33
Corrected mass of soil used in hydrometer test (g):	101.23

Hydrometer Test

Hydrometer type:	
Hydrometer correction:	0.002
Average temperature (C):	20
Temperature correction factor:	0
Total Hydrometer correction:	0.002

Values

K:	0.01365
W:	107.25
F:	6.02

Results: 009

Sieve Analysis

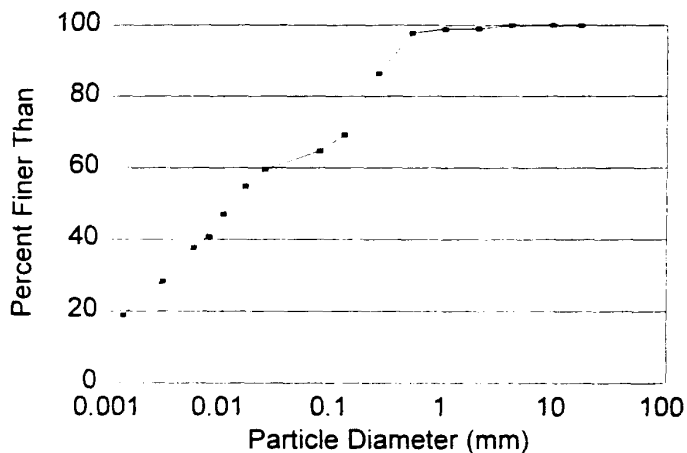
Sieve Size (mm)	Mass Retained (g)	Hygroscopic Corrected Mass Retained (g)	Mass Retained Corrected for F (g)	Mass Passing (g)	Percent Finer Than
16	0.00	0.00	0.00	102.44	100.00
9.5	0.00	0.00	0.00	102.44	100.00
4	0.00	0.00	0.00	102.44	100.00
2	3.14	3.10	1.03	101.41	98.99

Hydrometer Test Analysis

Time, T (Minutes)	Hydrometer Reading	Corrected Reading	Length, L (cm)	Diameter (mm)	Percent Suspended
2	1.040	1.038	6.24	0.0241	59.58
5	1.037	1.035	7.04	0.0162	54.87
15	1.032	1.03	8.36	0.0102	47.03
30	1.028	1.026	9.42	0.0076	40.76
60	1.026	1.024	9.95	0.0056	37.63
250	1.020	1.018	11.53	0.0029	28.22
1440	1.014	1.012	13.12	0.0013	18.81

Sieve Analysis <No.10

Size (mm)	Mass Retained (g)	Mass Passing (g)	Percent Finer Than
1	0.05	101.35	98.94
0.5	1.17	100.18	97.79
0.25	11.64	88.54	86.43
0.125	17.58	70.96	69.27
0.075	4.60	66.36	64.78
TOTAL	35.04		



ASTM Grain Size	Particle Dia. (mm)	Percent Finer
Fine Gravel	16	100.00
Gravel	9.5	100.00
Course Sand	4	100.00
Sand	2	98.99
Medium Sand	1	98.94
Fine Sand	0.5	97.79
	0.25	86.43
	0.125	69.27
	0.075	64.78
	0.0241	59.58
	0.0162	54.87
Silt	0.0102	47.03
	0.0076	40.76
	0.0056	37.63
Clay	0.0029	28.22
	0.0013	18.81

PARTICLE SIZE ANALYSIS

Technician's name: Brian Holderness
Date: 02/27/98
Site name: Tennessee Products
Sample No.: *009

Sample Data

Mass of sample split on No. 10 sieve (g): 308.16
Mass retained on No. 10 sieve (g): 3.13
Mass passing No. 10 sieve (g): 305.03
Percent passing No. 10 sieve (g): 98.98

Mass used in Hydrometer test (g): 102.77
Specific gravity of soil: 2.65
Correction factor: 1
Corrected mass of soil used
in hydrometer test (g): 102.77

Hygroscopic Moisture

Wet mass of hygroscopic test sample (g): 15
Oven-dry mass of test sample (g): 14.8
Percent hygroscopic moisture: 1.33
Corrected mass of soil
used in hydrometer test (g): 101.40

Hydrometer Test

Hydrometer type: XXXXXXXXXX
Hydrometer correction: 0.002
Average temperature (C): 20
Temperature correction factor: 0
Total Hydrometer correction: 0.002

Values

K: 0.01365
W: 102.44
F: 1.04

Results: *008

Sieve Analysis

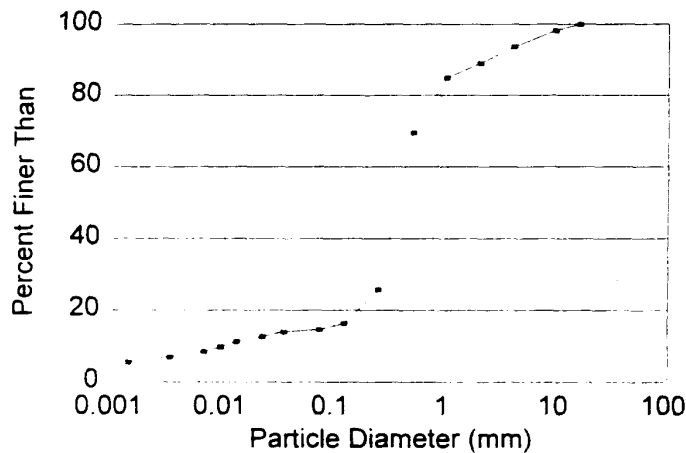
Sieve Size (mm)	Mass Retained (g)	Hygroscopic Corrected Mass Retained (g)	Mass Retained Corrected for F (g)	Mass Passing (g)	Percent Finer Than
16	0.00	0.00	0.00	115.51	100.00
9.5	8.05	7.94	2.10	113.42	98.19
4	19.88	19.61	5.18	108.24	93.70
2	21.26	20.98	5.54	102.71	88.91

Hydrometer Test Analysis

Time, T (Minutes)	Hydrometer Reading	Corrected Reading	Length, L (cm)	Diameter (mm)	Percent Suspended
2	1.012	1.01	13.65	0.0357	13.90
5	1.011	1.009	13.91	0.0228	12.51
15	1.010	1.008	14.18	0.0133	11.12
30	1.009	1.007	14.44	0.0095	9.73
60	1.008	1.006	14.71	0.0068	8.34
250	1.007	1.005	14.97	0.0033	6.95
1440	1.006	1.004	15.24	0.0014	5.56

Sieve Analysis <No.10

Size (mm)	Mass Retained (g)	Mass Passing (g)	Percent Finer Than
1	3.00	98.07	84.90
0.5	17.75	80.32	69.54
0.25	50.61	29.71	25.72
0.125	10.96	18.75	16.24
0.075	1.94	16.81	14.56
TOTAL	84.26		



ASTM Grain Size	Particle Dia. (mm)	Percent Finer
Fine Gravel	16	100.00
Gravel	9.5	98.19
Course Sand	4	93.70
Sand	2	88.91
Medium Sand	1	84.90
Fine Sand	0.5	69.54
	0.25	25.72
	0.125	16.24
	0.075	14.56
	0.0357	13.90
	0.0228	12.51
Silt	0.0133	11.12
	0.0095	9.73
	0.0068	8.34
Clay	0.0033	6.95
	0.0014	5.56

PARTICLE SIZE ANALYSIS

Technician's name:

Brian Holderness

Date:

02/27/98

Site name:

Tennessee Products

Sample No.:

*008

Sample Data

Mass of sample split on No. 10 sieve (g):

437.74

Mass retained on No. 10 sieve (g):

54.72

Mass passing No. 10 sieve (g):

383.02

Percent passing No. 10 sieve (g):

87.50

Mass used in Hydrometer test (g):

102.44

Specific gravity of soil:

2.65

Correction factor:

1

Corrected mass of soil used

in hydrometer test (g):

102.44

Hygroscopic Moisture

Wet mass of hygroscopic test sample (g):

15

Oven-dry mass of test sample (g):

14.8

Percent hygroscopic moisture:

1.33

Corrected mass of soil

used in hydrometer test (g):

101.07

Hydrometer Test

Hydrometer type:

Hydrometer correction:

0.002

Average temperature (C):

20

Temperature correction factor:

0

Total Hydrometer correction:

0.002

Values

K: 0.01365

W: 115.51

F: 14.44

Client/Toxicant: 48
 Project Number: 02-01
 Species: C. tentans

Beginning Date & Time: 2-20-98 430p
 Ending Date & Time: 3-6-98 300pm
 Hatch Date: _____

American Aquatic Testing, Inc.
 Weight Data

Conc.	Rep	Pan #	A weight of boat (g)	B weight of boat & org. (g)	(B-A)*1000=C dry weight of organisms (mg)	D # of surviving org.	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
25%	A	33 B	0.00774	0.01161	3.87	2	1.935	
	B	34 D	0.00860	0.00932	0.66	1	0.660	
	C	35 F	0.00869	0.00888	0.29	1	0.290	
	D	36 G	0.00812	0.00835	0.23	1	0.230	
	E	37 H	0.00838	0.00846	0.58	1	0.580	
	F							
	G							
	H							
50%	A	38 B	0.00860	0.00940	1.14	3	0.380	
	B	39 H	0.00798	0.00878	0.80	1	0.800	
	C							
	D							
	E							
	F							
	G							
	H							
REM-1	A	40	0.00854	0.01384	5.30	7	0.757	
	B	41	0.00833	0.01934	11.01	10	1.101	
	C	42	0.00733	0.01487	7.54	8	0.943	
	D	43	0.00748	0.01473	7.25	8	0.906	
	E	44	0.00723	0.01451	7.28	7	1.040	
	F	45	0.00760	0.01715	9.29	9	1.032	
	G	46	0.00816	0.01687	8.72	7	1.246	
	H	47	0.00773	0.01466	6.93	8	0.866	
REM-2	A	48	0.00869	0.01011	1.42	2	0.710	
	B	49	0.00799	0.01000	2.01	2	1.005	
	C	50	0.00764	0.00996	2.42	2	1.210	
	D	51	0.00808	0.01109	2.01	3	0.670	
	E	52	0.00809	0.00899	0.90	2	0.450	
	F	53	0.00826	0.01015	1.89	1	1.890	
	G	54	0.00836	0.00937	1.01	1	1.010	
	H							
Initials			<u>TR</u>	<u>TR</u>	<u>TR</u>	<u>TR</u>	<u>TR</u>	
Date			<u>3/6</u>	<u>3/7</u>	<u>3/7</u>	<u>3/6</u>	<u>3/7</u>	

E = Original number of organisms at test initiation, adjusted for losses.

Observations:

Client/Toxicant: 48
 Project Number: 02-01
 Species: C. tentaculatus

Beginning Date & Time: 2-20-92 4:30pm
 Ending Date & Time: 3-6-92 3:00pm
 Hatch Date: —

American Aquatic Testing, Inc.
 Weight Data

Conc.	Rep	Pan #	A weight of boat (g)	B weight of boat & org. (g)	(B-A)*1000=C dry weight of organisms (mg)	D # of surviving org.	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
Con	A	1	0.00779	0.01630	8.51	9	0.946	
	B	2	0.00789	0.01494	7.05	6	1.175	
	C	3	0.00806	0.01661	8.55	9	0.950	
	D	4	0.00667	0.01634	9.67	7	1.381	
	E	5	0.00772	0.01695	9.83	9	1.092	
	F	6	0.00683	0.01338	6.55	7	0.936	
	G	7	0.00596	0.01524	9.29	7	1.327	
	H	8	0.00669	0.01507	8.38	9	0.931	
REF	A	9	0.00677	0.01242	5.65	6	0.942	
	B	10	0.00713	0.01285	5.72	8	0.715	
	C	11	0.00658	0.01420	7.62	7	1.089	
	D	12	0.00765	0.01770	10.15	9	1.128	
	E	13	0.00691	0.01717	10.26	7	1.466	
	F	14	0.00648	0.01494	8.46	8	1.058	
	G	15	0.00689	0.01610	9.21	8	720	
	H	16	0.00721	0.01393	6.72	8	0.840	
6%	A	17	0.00776	0.01494	7.18	7	1.026	
	B	18	0.00749	0.01378	6.29	7	0.899	
	C	19	0.00793	0.01387	5.94	8	0.743	
	D	20	0.00741	0.01422	6.31	9	0.701	
	E	21	0.00723	0.01543	8.20	9	0.911	
	F	22	0.00742	0.01412	6.20	6	1.033	
	G	23	0.00691	0.01338	6.47	7	0.924	
	H	24	0.00753	0.01627	8.74	7	1.249	
12%	A	25	0.00801	0.01587	7.86	8	0.983	
	B	26	0.00786	0.01225	5.30	5	1.060	
	C	27	0.00828	0.01264	4.36	4	1.090	
	D	28	0.00804	0.01561	7.57	7	1.081	
	E	29	0.00761	0.01399	6.38	5	1.276	
	F	30	0.00831	0.01734	9.03	7	1.290	
	G	31	0.00768	0.01216	4.48	5	0.896	
	H	32	0.00821	0.01567	7.46	6	1.243	
Initials			<u>TRP</u>	<u>TRP</u>	<u>TRP</u>	<u>TRP</u>	<u>TRP</u>	
Date			<u>2/26</u>	<u>3/7</u>	<u>3/7</u>	<u>3/6</u>	<u>3/7</u>	

E = Original number of organisms at test initiation, adjusted for losses.

Observations: ① 1.151 - TRP 3/7

Client/Toxicant: 48
 Project Number: 02-01
 Species: C. tentans and H. azteca (Initial weights)

Beginning Date & Time: 2-20-98
 Ending Date & Time: 3-6-98
 Hatch Date: —

American Aquatic Testing, Inc.
 Weight Data

Initial weights Conc.	Rep	Pan #	A weight of boat (g)	B weight of boat & org. (g)	(B-A)*1000=C dry weight of organisms (mg)	D # of surviving org.	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
Chironomid Tentans	A	1	0.00894	0.01027	1.33	10	0.133	
	B	2	0.00860	0.01069	2.09	10	0.209	
	C							
	D							
	E							
	F							
	G							
	H							
Hyalella azteca	A	1	0.00724	0.00779	0.55	10	0.055	
	B	2	0.00794	0.00835	0.41	10	0.041	
	C							
	D							
	E							
	F							
	G							
	H							
	A							
	B							
	C							
	D							
	E							
	F							
	G							
	H							
	A							
	B							
	C							
	D							
	E							
	F							
	G							
	H							
Initials	TAP		TAP		TAP		TAP	
Date	2/21		2/23		2/23		2/21	

E = Original number of organisms at test initiation, adjusted for losses.

Observations:

APPENDIX E

RAW DATA FOR *Chironomus tentans* 14 DAY

SURVIVAL AND GROWTH TEST

REAC Tennessee Prod. H.azteca growth data 02/21/98
 File: c:\toxstat\480201ha.g02 Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.144	7.744	12.224	7.744	2.144
OBSERVED	0	13	10	7	2

Calculated Chi-Square goodness of fit test statistic = 6.1971
 Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

REAC Tennessee Prod. H.azteca growth data 02/21/98
 File: c:\toxstat\480201ha.g02 Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
 Calculated B1 statistic = 13.13

Table Chi-square value = 11.34 (alpha = 0.01, df = 3)
 Table Chi-square value = 7.81 (alpha = 0.05, df = 3)

Data FAIL B1 homogeneity test at 0.01 level. Try another transformation.

REAC Tennessee Prod. H.azteca growth data 02/21/98
 File: c:\toxstat\480201ha.g02 Transform: NO TRANSFORMATION

STEEL'S MANY-ONE RANK TEST			- Ho:Control<Treatment			
GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	Reference	0.041				
2	6%	0.051	76.50	48.00	8.00	
3	12%	0.061	75.00	48.00	8.00	
4	REM-1	0.031	58.00	48.00	8.00	

Critical values use k = 3, are 1 tailed, and alpha = 0.05

REAC Tennessee Prod. H.azteca growth data 02/21/98
 File: 480201ha.g02 Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Reference	8	0.020	0.066	0.041
2	6%	8	0.020	0.080	0.051
3	12%	8	0.000	0.140	0.061
4	REM-1	8	0.000	0.130	0.031

REAC Tennessee Prod. H.azteca growth data 02/21/98
 File: 480201ha.g02 Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Reference	0.000	0.015	0.005	36.45
2	6%	0.001	0.023	0.008	45.15
3	12%	0.003	0.058	0.021	96.43
4	REM-1	0.002	0.049	0.017	155.30

TITLE: REAC Tennessee Prod. H.azteca growth data 02/21/98
 FILE: 480201ha.g02
 TRANSFORM: NO TRANSFORM NUMBER OF GROUPS: 4

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Reference	1	0.0660	0.0660
1	Reference	2	0.0550	0.0550
1	Reference	3	0.0410	0.0410
1	Reference	4	0.0340	0.0340
1	Reference	5	0.0200	0.0200
1	Reference	6	0.0470	0.0470
1	Reference	7	0.0260	0.0260
1	Reference	8	0.0400	0.0400
2	6%	1	0.0700	0.0700
2	6%	2	0.0630	0.0630
2	6%	3	0.0200	0.0200
2	6%	4	0.0320	0.0320
2	6%	5	0.0500	0.0500
2	6%	6	0.0720	0.0720
2	6%	7	0.0250	0.0250
2	6%	8	0.0800	0.0800
3	12%	1	0.0000	0.0000
3	12%	2	0.1400	0.1400
3	12%	3	0.0000	0.0000
3	12%	4	0.0000	0.0000
3	12%	5	0.1400	0.1400
3	12%	6	0.0700	0.0700
3	12%	7	0.0750	0.0750
3	12%	8	0.0600	0.0600
4	REM-1	1	0.0000	0.0000
4	REM-1	2	0.0700	0.0700
4	REM-1	3	0.0000	0.0000
4	REM-1	4	0.0000	0.0000
4	REM-1	5	0.0000	0.0000
4	REM-1	6	0.1300	0.1300
4	REM-1	7	0.0000	0.0000
4	REM-1	8	0.0500	0.0500

REAC Tennessee Prod. H.azteca survival data 02/21/98
 File: c:\toxstat\480201ha.s02 Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	4.288	15.488	24.448	15.488	4.288
OBSERVED	2	14	37	9	2

Calculated Chi-Square goodness of fit test statistic = 11.7469
 Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

REAC Tennessee Prod. H.azteca survival data 02/21/98
 File: c:\toxstat\480201ha.s02 Transform: NO TRANSFORMATION

Hartley's test for homogeneity of variance
 Bartlett's test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption.
 Additional transformations are useless.

REAC Tennessee Prod. H.azteca survival data 02/21/98
 File: c:\toxstat\480201ha.s02 Transform: NO TRANSFORMATION

STEEL'S MANY-ONE RANK TEST			- Ho:Control<Treatment			
GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	Reference	0.850				
2	6%	0.463	36.00	45.00	8.00	*
3	12%	0.100	36.00	45.00	8.00	*
4	25%	0.000	36.00	45.00	8.00	*
5	50%	0.000	36.00	45.00	8.00	*
6	ACTR	0.000	36.00	45.00	8.00	*
7	REM-1	0.038	36.00	45.00	8.00	*
8	REM-2	0.000	36.00	45.00	8.00	*

Critical values use k = 7, are 1 tailed, and alpha = 0.05

REAC Tennessee Prod. H.azteca survival data 02/21/98

File: c:\toxstat\480201ha.s02

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Reference	8	0.700	1.000	0.850
2	6%	8	0.300	0.600	0.463
3	12%	8	0.000	0.300	0.100
4	25%	8	0.000	0.000	0.000
5	50%	8	0.000	0.000	0.000
6	ACTR	8	0.000	0.000	0.000
7	REM-1	8	0.000	0.100	0.038
8	REM-2	8	0.000	0.000	0.000

REAC Tennessee Prod. H.azteca survival data 02/21/98

File: c:\toxstat\480201ha.s02

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Reference	0.009	0.093	0.033	10.89
2	6%	0.011	0.106	0.038	22.93
3	12%	0.011	0.107	0.038	106.90
4	25%	0.000	0.000	0.000	N/A
5	50%	0.000	0.000	0.000	N/A
6	ACTR	0.000	0.000	0.000	N/A
7	REM-1	0.003	0.052	0.018	138.01
8	REM-2	0.000	0.000	0.000	N/A

7	REM-1	2	0.1000	0.1000
7	REM-1	3	0.0000	0.0000
7	REM-1	4	0.0000	0.0000
7	REM-1	5	0.0000	0.0000
7	REM-1	6	0.1000	0.1000
7	REM-1	7	0.0000	0.0000
7	REM-1	8	0.1000	0.1000
8	REM-2	1	0.0000	0.0000
8	REM-2	2	0.0000	0.0000
8	REM-2	3	0.0000	0.0000
8	REM-2	4	0.0000	0.0000
8	REM-2	5	0.0000	0.0000
8	REM-2	6	0.0000	0.0000
8	REM-2	7	0.0000	0.0000
8	REM-2	8	0.0000	0.0000

TITLE: REAC Tennessee Prod. H.azteca survival data 02/21/98

FILE: c:\toxstat\480201ha.s02

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 8

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Reference	1	0.9000	0.9000
1	Reference	2	0.8000	0.8000
1	Reference	3	0.9000	0.9000
1	Reference	4	1.0000	1.0000
1	Reference	5	0.8000	0.8000
1	Reference	6	0.7000	0.7000
1	Reference	7	0.9000	0.9000
1	Reference	8	0.8000	0.8000
2	6%	1	0.6000	0.6000
2	6%	2	0.4000	0.4000
2	6%	3	0.3000	0.3000
2	6%	4	0.5000	0.5000
2	6%	5	0.6000	0.6000
2	6%	6	0.5000	0.5000
2	6%	7	0.4000	0.4000
2	6%	8	0.4000	0.4000
3	12%	1	0.0000	0.0000
3	12%	2	0.1000	0.1000
3	12%	3	0.0000	0.0000
3	12%	4	0.0000	0.0000
3	12%	5	0.1000	0.1000
3	12%	6	0.3000	0.3000
3	12%	7	0.2000	0.2000
3	12%	8	0.1000	0.1000
4	25%	1	0.0000	0.0000
4	25%	2	0.0000	0.0000
4	25%	3	0.0000	0.0000
4	25%	4	0.0000	0.0000
4	25%	5	0.0000	0.0000
4	25%	6	0.0000	0.0000
4	25%	7	0.0000	0.0000
4	25%	8	0.0000	0.0000
5	50%	1	0.0000	0.0000
5	50%	2	0.0000	0.0000
5	50%	3	0.0000	0.0000
5	50%	4	0.0000	0.0000
5	50%	5	0.0000	0.0000
5	50%	6	0.0000	0.0000
5	50%	7	0.0000	0.0000
5	50%	8	0.0000	0.0000
6	ACTR	1	0.0000	0.0000
6	ACTR	2	0.0000	0.0000
6	ACTR	3	0.0000	0.0000
6	ACTR	4	0.0000	0.0000
6	ACTR	5	0.0000	0.0000
6	ACTR	6	0.0000	0.0000
6	ACTR	7	0.0000	0.0000
6	ACTR	8	0.0000	0.0000
7	REM-1	1	0.0000	0.0000

APPENDIX D

STATISTICAL DATA FOR *Hyaella azteca* 14 DAY

SURVIVAL AND GROWTH TEST

USING TENNESSEE SITE REFERENCE SEDIMENT

REAC Tennessee Prod. H.azteca growht data 02/21/98

File: c:\toxstat\480201ha.g01

Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	3	0.004	0.001	0.764
Within (Error)	28	0.048	0.002	
Total	31	0.052		

Critical F value = 2.95 (0.05,3,28)

Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal

REAC Tennessee Prod. H.azteca growht data 02/21/98

File: c:\toxstat\480201ha.g01

Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2

H_0 :Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	0.055	0.055		
2	6%	0.051	0.051	0.163	
3	12%	0.061	0.061	-0.278	
4	REM-1	0.031	0.031	1.143	

Dunnett table value = 2.17 (1 Tailed Value, $P=0.05$, $df=24,3$)

REAC Tennessee Prod. H.azteca growht data 02/21/98

File: c:\toxstat\480201ha.g01

Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2

H_0 :Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	control	8			
2	6%	8	0.045	81.8	0.003
3	12%	8	0.045	81.8	-0.006
4	REM-1	8	0.045	81.8	0.024

REAC Tennessee Prod. H.azteca growht data 02/21/98
File: c:\toxstat\480201ha.g01 Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
EXPECTED	2.144	7.744	12.224	7.744	2.144
OBSERVED	0	13	9	8	2

Calculated Chi-Square goodness of fit test statistic = 6.5798

Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

REAC Tennessee Prod. H.azteca growht data 02/21/98
File: c:\toxstat\480201ha.g01 Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 8.69

Table Chi-square value = 11.34 (alpha = 0.01, df = 3)

Table Chi-square value = 7.81 (alpha = 0.05, df = 3)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

REAC Tennessee Prod. H.azteca growht data 02/21/98
 File: c:\toxstat\480201ha.g01 Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	control	8	0.024	0.093	0.055
2	6%	8	0.020	0.080	0.051
3	12%	8	0.000	0.140	0.061
4	REM-1	8	0.000	0.130	0.031

REAC Tennessee Prod. H.azteca growht data 02/21/98
 File: c:\toxstat\480201ha.g01 Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	control	0.001	0.023	0.008	41.88
2	6%	0.001	0.023	0.008	45.15
3	12%	0.003	0.058	0.021	96.43
4	REM-1	0.002	0.049	0.017	155.30

Earthworm Tests-TN products 2/98

File: TNPRODWM Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	6	0.003	0.001	0.579
Within (Error)	14	0.012	0.001	
Total	20	0.015		

Critical F value = 2.85 (0.05,6,14)

Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal

Earthworm Tests-TN products 2/98

File: TNPRODWM

Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2

Ho:Control=Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Reference sed.	0.036	0.036		
2	TA	0.049	0.049	-0.521	
3	S-1	0.029	0.029	0.302	
4	S-2	0.071	0.071	-1.413	
5	S-3	0.044	0.044	-0.329	
6	S-4	0.041	0.041	-0.178	
7	S-5	0.046	0.046	-0.398	

Dunnett table value = 2.91 (2 Tailed Value, P=0.05, df=14,6)

Earthworm Tests-TN products 2/98

File: TNPRODWM

Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2

Ho:Control=Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Reference sed.	3			
2	TA	3	0.071	194.6	-0.013
3	S-1	3	0.071	194.6	0.007
4	S-2	3	0.071	194.6	-0.034
5	S-3	3	0.071	194.6	-0.008
6	S-4	3	0.071	194.6	-0.004
7	S-5	3	0.071	194.6	-0.010

APPENDIX B

Final Report for the Earthworm Toxicity Test
Tennessee Products/Chattanooga Creek Superfund Site
Chattanooga, TN
February 1999

Date: March 25, 1998

TDD#: 98-0126

DCN#: 4B-8002

To: Alan Auwarter

From: ESAT Biological Assessment Team

Concerning: Results of Earthworm Toxicity Tests Performed on Seven Soil Samples from Tennessee Products Superfund Site, February 1998.

Introduction:

Earthworm toxicity tests were performed seven soil samples from the Tennessee Products site
Methods:

Toxicity tests were conducted according to the test conditions outlined in the Summary of Test Conditions sheet included in the project Field Sampling and Analysis Plan but with the following changes. Because of the need to maximize biomass for determining bioaccumulation, the number of worms per test chamber was increased from 10 to 40 with an accompanying increase in soil mass to 800 grams and an increase in test chamber volume to 1000 ml. A copy of the final test conditions is attached to this report.

The tests were conducted for 14 days, after which worm survival and condition were noted and recorded. A positive control sediment containing 2-chloracetamide was tested along with the test soils. Because of the number of worms needed for bioaccumulation, we did not have enough worms to setup a complete negative control consisting of three replicates. The negative control consisted of only one test chamber containing 20 worms. Worm weight was measured both before and after testing. Prior to weighing, the worms guts were allowed to purge. Then the worms were washed of fecal matter and soil, blotted on a clean paper towel to remove excess water, and finally weighed.

For statistical analyses, survival and weight change of worms in each test soil were compared to survival and weight change of worms in the reference soil. Dunnett's Test was used for the comparisons after the data was checked for normality and homogeneity of variance. For weight change analyses, the difference in the actual weight of the worms before and after testing were used. In Table 1 (below) the change in weight is expressed as a percent. The percent change in weight is easier to visualize but it was impossible to analyze statistically. Therefore, actual weights (in grams) were used for statistical comparisons. Printouts of the statistical analyses are appended to the data sheets.

Results:

Table 1. Results of Earthworm Toxicity Tests Performed on Soil Samples from Tennessee Products Superfund Site, Chattanooga, Tennessee, February 1998.

Sample ID	% Survival	% change in av. wt.
Positive Control (2-chloroacetamide)	0	100
Negative Control (artificial soil only)	90	---
Reference Soil	99	- 9.7
TA	100	- 11.6
S-1	96	- 6.9
S-2	100	- 13.9
S-3	98	- 10.1
S-4	100	- 8.7
S-5	99	- 10.8

An asterisk (*) indicates that this value is significantly different, statistically, from the corresponding value for the reference soil.

Conclusion/Discussion:

It is evident that none of the test soils were "toxic" to the worms. Worm survival ranged from 96% to 100%. Likewise, analysis of worm weight gave no indication of "toxicity." None of the average weight changes recorded for worms exposed to test soil were significantly different from the average weight change for worms in the reference soil.

No other chronic effects (e.g. avoidance or lethargy) were observed either. In fact all the worms exposed to test soil were quite active and readily borrowed through the soil.

TITLE: Earthworm Tests-TN products 2/98

FILE: TNPRODWM

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Reference sed.	1	0.0350	0.0350
1	Reference sed.	2	0.0370	0.0370
1	Reference sed.	3	0.0370	0.0370
2	TA	1	0.0120	0.0120
2	TA	2	0.0770	0.0770
2	TA	3	0.0580	0.0580
3	S-1	1	0.0080	0.0080
3	S-1	2	0.0410	0.0410
3	S-1	3	0.0380	0.0380
4	S-2	1	0.0140	0.0140
4	S-2	2	0.1230	0.1230
4	S-2	3	0.0750	0.0750
5	S-3	1	0.0480	0.0480
5	S-3	2	0.0370	0.0370
5	S-3	3	0.0480	0.0480
6	S-4	1	0.0670	0.0670
6	S-4	2	0.0000	0.0000
6	S-4	3	0.0550	0.0550
7	S-5	1	0.0380	0.0380
7	S-5	2	0.0300	0.0300
7	S-5	3	0.0700	0.0700

Earthworm Tests-TN products 2/98

File: TNPRODWM Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Reference sed.	3	0.035	0.037	0.036
2	TA	3	0.012	0.077	0.049
3	S-1	3	0.008	0.041	0.029
4	S-2	3	0.014	0.123	0.071
5	S-3	3	0.037	0.048	0.044
6	S-4	3	0.000	0.067	0.041
7	S-5	3	0.030	0.070	0.046

Earthworm Tests-TN products 2/98

File: TNPRODWM Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Reference sed.	0.000	0.001	0.001	3.18
2	TA	0.001	0.033	0.019	68.21
3	S-1	0.000	0.018	0.011	62.93
4	S-2	0.003	0.055	0.032	77.31
5	S-3	0.000	0.006	0.004	14.33
6	S-4	0.001	0.036	0.021	87.85
7	S-5	0.000	0.021	0.012	46.01

Earthworm Tests-TN products 2/98
File: TNPRODWM Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.012

W = 0.963

Critical W (P = 0.05) (n = 21) = 0.908

Critical W (P = 0.01) (n = 21) = 0.873

Data PASS normality test at P=0.01 level. Continue analysis.

Earthworm Tests-TN products 2/98
File: TNPRODWM Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 15.85

Table Chi-square value = 16.81 (alpha = 0.01, df = 6)
Table Chi-square value = 12.59 (alpha = 0.05, df = 6)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

EARTHWORM WEIGHT DATA (wet weight)

Study: TN Products

Date Start: 2/19/98 1600

Species: Eisenia foetida

Location: Chattanooga, TN

Date Stop: 2/5/98 1600

Analyst(s): Mandley, Dorn, Wenzel

Sample ID	Rep #	Initial # Worms	Initial Wt Worms	A		Final # worms	Final Wt Worms	B		Difference in Av. Wt.	$\frac{A-B}{A}$ % change in Av. Wt.
				Av. Wt. (initial) gm				Av. Wt. (final) gm	A-B		
Reference sed.	1	40	15.0	0.375		40	13.6	0.340	-0.035		9.3
	2	40	15.0	0.375		40	13.3	0.333	-0.037		9.9
	3	40	15.0	0.375		39	13.0	0.333	-0.037		9.9
TRA	1	40	15.0 16.4	0.375		40	14.5	0.363	-0.012		3.2
	2	40	15.0 16.9	0.410		40	13.2	0.333	-0.077		18.8
	3	40	15.0 17.9	0.448		40	15.6	0.390	-0.058		12.9
S-1	1	40	16.0	0.400		39	15.3	0.392	-0.008		2.0
	2	40	16.0	0.400		37	13.3	0.359	-0.041		10.3
	3	40	17.9	0.448		39	16.0	0.410	-0.038		8.5
S-2	1	40	16.3	0.408		35*	13.8*	0.394	-0.014		3.4
	2	40	21.1	0.528		42	17.0	0.405	-0.123		23.3
	3	40	20.1	0.503		40	17.1	0.428	-0.075		14.9
S-3	1	40	18.3	0.458		40 ³⁹	16.0	0.410	-0.048		10.5
	2	40	16.3	0.408		38	14.1	0.371	-0.037		9.1
	3	40	17.9	0.448		40	16.0	0.400	-0.048		10.7
-	-	-	-	-		-	-	-	-		-

* 40 worms survived testing but 5 were lost (escapeds) during purging.

EARTHWORM WEIGHT DATA (wet weight)

Study: TN Products

Date Start: 2/19/98 /600

Species *Eisenia foetida*

Location: Chatham Co, TN

Date Stop: 3 / 5 / 98 / 600

Analyst(s) Mand, Ley, Dorn, Wenholz

[illegible]

WORM SURVIVAL AND WEIGHT

Study: Tennessee Product Date Start: 2/19/98 1600 Species: Eisenia foetida
 Location: Chattanooga, TN Date Stop: _____ Analyst: mm

Sample ID	rep. #	Wt. of worms Day 0	# worms Day 0	# worms Day 7	# worms Day 14	Wt. of worms Day 14	Change in weight	Initial pH	End pH
Positive Control	1	17.0	40	0	-	-	-	6.58	8.3
	2	16.5	40	0	-	-	-		
	3	17.1	40	0	-	-	-		
	-								
Negative Control	1	5.6	20	18	18	5.3		6.85	7.6
	-	-	-	-	-	-	-		
	-	-	-	-	-	-	-		
	-	-	-	-	-	-	-		
S-1	1	16.0	40	39	39	13.3 13.3		6.04	5.5
	2	16.0	40	40	37	13.3			
	3	17.9	40	40	39	16.0			
	-								
S-2	1	16.3	40	40	40	13.8*		5.48	4.9
	2	21.1	40	42	42	17.0			
	3	20.1	40	40	40	17.1			
	-								
S-3	1	18.3	40	40	39	16.0		6.47	5.1
	2	16.8	40	38	38	14.1			
	3	17.9	40	40	40	16.0			
	-								
S-4	1	18.4	40	40	40	15.7		6.58	5.4
	2	15.1	40	40	40	15.2 15.2			
	3	17.6	40	42	40 ⁴¹	15.8			
	-								

Positive Control = Artificial soil spiked w/ 2-chloroacetamide
 to give a final soil conc. of 100 ppm.

Negative Control = Artificial Soil only.

* Wt. is for 35 worms, ^{five} escaped container because lid was ajar.

WORM SURVIVAL AND WEIGHT

Study: Tennessee Products Date Start: 2/19/98 1600 Species: Eisenia foetida
Location: Chattanooga, TN Date Stop: _____ Analyst: JRM

[illegible]

APPENDIX C

Final Analytical Reports
Tennessee Products/Chattanooga Creek Superfund Site
Chattanooga, TN
February 1999

PARTICLE SIZE ANALYSIS

Technician's name: Brian Holderness
Date: 02/27/98
Site name: Tennessee Products
Sample No.: *001

Sample Data

Mass of sample split on No. 10 sieve (g):	656.62
Mass retained on No. 10 sieve (g):	250
Mass passing No. 10 sieve (g):	406.62
Percent passing No. 10 sieve (g):	61.93

Mass used in Hydrometer test (g):	102.77
Specific gravity of soil:	2.65
Correction factor:	1
Corrected mass of soil used in hydrometer test (g):	102.77

Hygroscopic Moisture

Wet mass of hygroscopic test sample (g):	15
Oven-dry mass of test sample (g):	14.8
Percent hygroscopic moisture:	1.33
Corrected mass of soil used in hydrometer test (g):	101.40

Hydrometer Test

Hydrometer type:	
Hydrometer correction:	0.002
Average temperature (C):	20
Temperature correction factor:	0
Total Hydrometer correction:	0.002

Values

K:	0.01365
W:	163.74
F:	62.34

Results: *001

Sieve Analysis

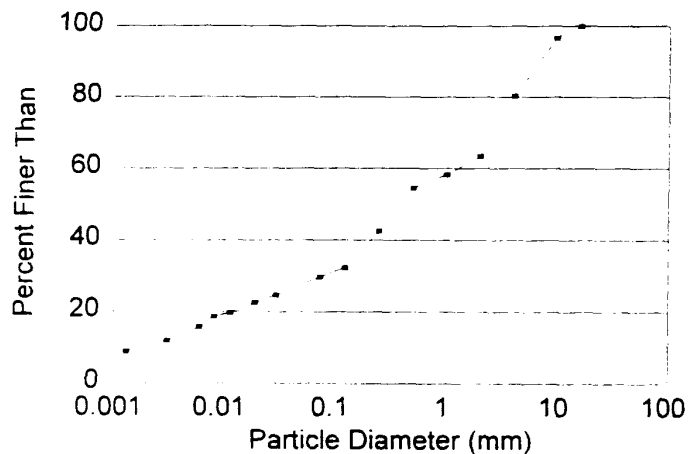
Sieve Size (mm)	Mass Retained (g)	Hygroscopic Corrected Mass Retained (g)	Mass Retained Corrected for F (g)	Mass Passing (g)	Percent Finer Than
16	0.00	0.00	0.00	163.74	100.00
9.5	22.44	22.14	5.52	158.22	96.63
4	107.91	106.47	26.55	131.67	80.41
2	113.36	111.85	27.89	103.78	63.38

Hydrometer Test Analysis

Time, T (Minutes)	Hydrometer Reading	Corrected Reading	Length, L (cm)	Diameter (mm)	Percent Suspended
2	1.027	1.025	9.68	0.0300	24.52
5	1.025	1.023	10.21	0.0195	22.56
15	1.022	1.02	11.00	0.0117	19.62
30	1.021	1.019	11.27	0.0084	18.64
60	1.018	1.016	12.06	0.0061	15.69
250	1.014	1.012	13.12	0.0031	11.77
1440	1.011	1.009	13.91	0.0013	8.83

Sieve Analysis <No.10

Size (mm)	Mass Retained (g)	Mass Passing (g)	Percent Finer Than
1	5.94	95.46	58.30
0.5	6.29	89.17	54.46
0.25	19.56	69.61	42.51
0.125	16.75	52.86	32.28
0.075	4.27	48.59	29.67
TOTAL	52.81		



ASTM Grain Size	Particle Dia. (mm)	Percent Finer
Fine Gravel	16	100.00
Gravel	9.5	96.63
Course Sand	4	80.41
Sand	2	63.38
Medium Sand	1	58.30
Sand	0.5	54.46
Fine Sand	0.25	42.51
	0.125	32.28
	0.075	29.67
	0.0300	24.52
	0.0195	22.56
Silt	0.0117	19.62
	0.0084	18.64
	0.0061	15.69
	0.0031	11.77
Clay	0.0013	8.83

PARTICLE SIZE ANALYSIS

Technician's name:

Brian Holderness

Date:

02/27/98

Site name:

Tennessee Products

Sample No.:

*006

Sample Data

Mass of sample split on No. 10 sieve (g):

578.09

Mass retained on No. 10 sieve (g):

177.97

Mass passing No. 10 sieve (g):

400.12

Percent passing No. 10 sieve (g):

69.21

Mass used in Hydrometer test (g):

102.07

Specific gravity of soil:

2.65

Correction factor:

1

Corrected mass of soil used

in hydrometer test (g):

102.07

Hygroscopic Moisture

Wet mass of hygroscopic test sample (g):

15

Oven-dry mass of test sample (g):

14.8

Percent hygroscopic moisture:

1.33

Corrected mass of soil

used in hydrometer test (g):

100.71

Hydrometer Test

Hydrometer type:

Hydrometer correction:

0.002

Average temperature (C):

20

Temperature correction factor:

0

Total Hydrometer correction:

0.002

Values

K:

0.01365

W:

145.50

F:

44.79

Results: *006

Sieve Analysis

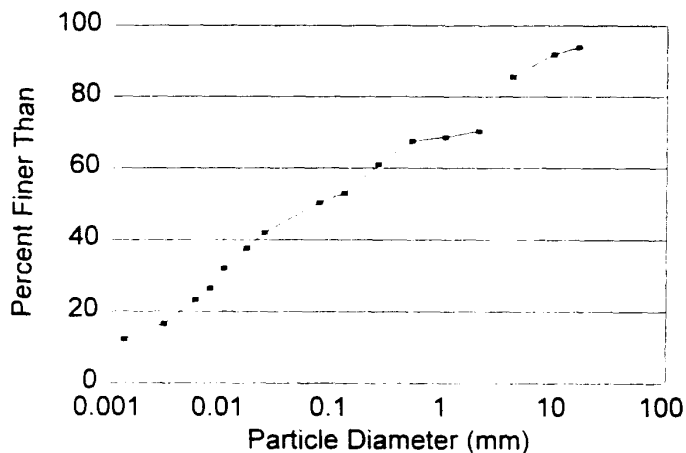
Sieve Size (mm)	Mass Retained (g)	Hygroscopic Corrected Mass Retained (g)	Mass Retained Corrected for F (g)	Mass Passing (g)	Percent Finer Than
16	35.58	35.11	8.84	136.67	93.93
9.5	11.55	11.40	2.87	133.80	91.96
4	37.26	36.76	9.25	124.55	85.60
2	89.52	88.33	22.23	102.31	70.32

Hydrometer Test Analysis

Time, T (Minutes)	Hydrometer Reading	Corrected Reading	Length, L (cm)	Diameter (mm)	Percent Suspended
2	1.040	1.038	6.24	0.0241	41.94
5	1.036	1.034	7.30	0.0165	37.53
15	1.031	1.029	8.62	0.0103	32.01
30	1.026	1.024	9.95	0.0079	26.49
60	1.023	1.021	10.74	0.0058	23.18
250	1.017	1.015	12.33	0.0030	16.56
1440	1.013	1.011	13.39	0.0013	12.14

Sieve Analysis <No.10

Size (mm)	Mass Retained (g)	Mass Passing (g)	Percent Finer Than
1	0.84	99.87	68.64
0.5	1.54	98.33	67.58
0.25	9.59	88.74	60.99
0.125	11.68	77.06	52.96
0.075	3.72	73.34	50.40
TOTAL	27.37		



ASTM Grain Size	Particle Dia. (mm)	Percent Finer
Fine Gravel	16	93.93
Gravel	9.5	91.96
Course Sand	4	85.60
Sand	2	70.32
Medium Sand	1	68.64
Sand	0.5	67.58
Fine Sand	0.25	60.99
	0.125	52.96
	0.075	50.40
	0.0241	41.94
	0.0165	37.53
Silt	0.0103	32.01
	0.0079	26.49
	0.0058	23.18
	0.0030	16.56
Clay	0.0013	12.14

PARTICLE SIZE ANALYSIS

Technician's name: Brian Holderness
Date: 02/27/98
Site name: Tennessee Products
Sample No.: *007

Sample Data

Mass of sample split on No. 10 sieve (g): 1187.07
Mass retained on No. 10 sieve (g): 633.97
Mass passing No. 10 sieve (g): 553.1
Percent passing No. 10 sieve (g): 46.59

Mass used in Hydrometer test (g): 102.69
Specific gravity of soil: 2.65
Correction factor: 1
Corrected mass of soil used
in hydrometer test (g): 102.69

Hygroscopic Moisture

Wet mass of hygroscopic test sample (g): 15
Oven-dry mass of test sample (g): 14.8
Percent hygroscopic moisture: 1.33
Corrected mass of soil
used in hydrometer test (g): 101.32

Hydrometer Test

Hydrometer type: XXXXXXXXXX
Hydrometer correction: 0.002
Average temperature (C): 20
Temperature correction factor: 0
Total Hydrometer correction: 0.002

Values

K: 0.01365
W: 217.46
F: 116.14

Results: *007

Sieve Analysis

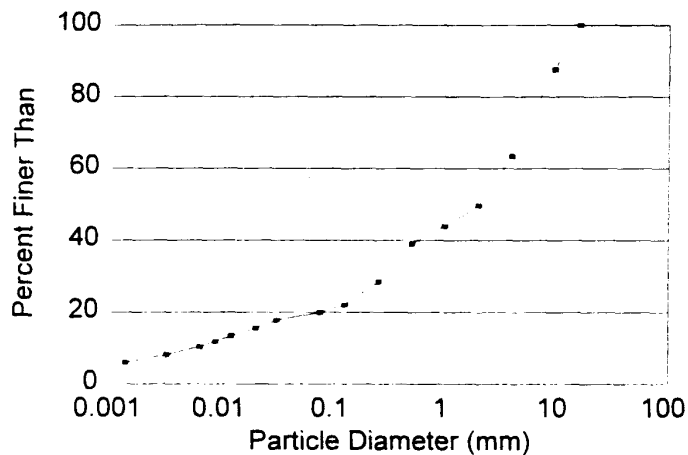
Sieve Size (mm)	Mass Retained (g)	Hygroscopic Corrected Mass Retained (g)	Mass Retained Corrected for F (g)	Mass Passing (g)	Percent Finer Than
16	0.00	0.00	0.00	217.46	100.00
9.5	148.03	146.06	26.76	190.70	87.70
4	291.90	288.01	52.76	137.94	63.43
2	166.13	163.91	30.03	107.91	49.63

Hydrometer Test Analysis

Time, T (Minutes)	Hydrometer Reading	Corrected Reading	Length, L (cm)	Diameter (mm)	Percent Suspended
2	1.026	1.024	9.95	0.0304	17.73
5	1.023	1.021	10.74	0.0200	15.51
15	1.020	1.018	11.53	0.0120	13.29
30	1.018	1.016	12.06	0.0087	11.82
60	1.016	1.014	12.59	0.0063	10.34
250	1.013	1.011	13.39	0.0032	8.12
1440	1.010	1.008	14.18	0.0014	5.91

Sieve Analysis <No.10

Size (mm)	Mass Retained (g)	Mass Passing (g)	Percent Finer Than
1	5.80	95.52	43.93
0.5	10.65	84.87	39.03
0.25	23.16	61.71	28.38
0.125	13.86	47.85	22.00
0.075	4.52	43.33	19.93
TOTAL	57.99		



ASTM Grain Size	Particle Dia. (mm)	Percent Finer
Fine Gravel	16	100.00
Gravel	9.5	87.70
Course Sand	4	63.43
Sand	2	49.63
Medium Sand	1	43.93
Sand	0.5	39.03
Fine Sand	0.25	28.38
	0.125	22.00
	0.075	19.93
	0.0304	17.73
	0.0200	15.51
Silt	0.0120	13.29
	0.0087	11.82
	0.0063	10.34
	0.0032	8.12
Clay	0.0014	5.91



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region 4

**Science and Ecosystem Support Division
980 College Station Road
Athens, Georgia 30605-2720**

MEMORANDUM

Date: 03/11/98

Subject: Results of VOLATILES ORGANIC Chemistry Section Sample Analysis
98-0241 Tennessee Products
Chattanooga, TN

*Soils
Sediments*

From: Frank Allen

To: Alan Auwarter

A handwritten signature in black ink, appearing to read "Frank Allen".

CC: SESD/EAB/EES

Thru: William McDaniel

Chief, ORGANIC Chemistry Section

A handwritten signature in black ink, appearing to read "William McDaniel".

Attached are the results of analysis of samples collected as part of the subject project. If you have any questions, please contact me.

ATTACHMENT

ATILES SAMPLE ANALYSIS

EPA - REGION IV SESD, ATHENS, GA

Production Date: 03/11/98 15:49

Sample **2374** FY **1998** Project: **98-0241**

Produced by: Frank Allen

VOLATILES SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station: REM1

Ending:

Media: SEDIM

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
15.U	UG/KG	TRICHLOROFLUOROMETHANE
15.U	UG/KG	CHLOROMETHANE
15.U	UG/KG	BROMOMETHANE
15.U	UG/KG	VINYL CHLORIDE
15.U	UG/KG	CHLOROETHANE
73.U	UG/KG	METHYLENE CHLORIDE
15.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)
1100.J	UG/KG	ACETONE
36.U	UG/KG	CARBON DISULFIDE
15.U	UG/KG	1,1-DICHLOROETHANE
15.U	UG/KG	CIS-1,2-DICHLOROETHENE
15.U	UG/KG	2,2-DICHLOROPROPANE
360.U	UG/KG	METHYL ETHYL KETONE
15.U	UG/KG	BROMOCHLOROMETHANE
15.U	UG/KG	TRANS-1,2-DICHLOROETHENE
15.U	UG/KG	CHLOROFORM
15.U	UG/KG	1,2-DICHLOROETHANE
15.U	UG/KG	1,1,1-TRICHLOROETHANE
15.U	UG/KG	1,1-DICHLOROPROPENE
15.U	UG/KG	CARBON TETRACHLORIDE
15.U	UG/KG	BROMODICHLOROMETHANE
36.U	UG/KG	METHYL ISOBUTYL KETONE
15.U	UG/KG	1,2-DICHLOROPROPANE
15.U	UG/KG	DIBROMOMETHANE
15.U	UG/KG	TRANS-1,3-DICHLOROPROPENE
15.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)
15.U	UG/KG	BENZENE
15.U	UG/KG	DIBROMOCHLOROMETHANE
15.U	UG/KG	1,1,2-TRICHLOROETHANE
15.U	UG/KG	CIS-1,3-DICHLOROPROPENE
15.U	UG/KG	BROMOFORM
15.U	UG/KG	BROMOBENZENE
15.U	UG/KG	1,1,2,2-TETRACHLOROETHANE
15.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)
15.U	UG/KG	1,3-DICHLOROPROPANE
36.U	UG/KG	METHYL BUTYL KETONE
15.U	UG/KG	TOLUENE
11.J	UG/KG	CHLOROBENZENE

RESULTS	UNITS	ANALYTE
15.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
15.U	UG/KG	ETHYL BENZENE
15.U	UG/KG	(M- AND/OR P-)XYLENE
15.U	UG/KG	O-XYLENE
15.U	UG/KG	STYRENE
15.U	UG/KG	1,2,3-TRICHLOROPROPANE
7.0J	UG/KG	O-CHLOROTOLUENE
15.U	UG/KG	P-CHLOROTOLUENE
15.U	UG/KG	1,3-DICHLOROBENZENE
15.U	UG/KG	1,4-DICHLOROBENZENE
15.U	UG/KG	1,2-DICHLOROBENZENE
15.U	UG/KG	1,2-DIBROMOETHANE (EDB)
15.U	UG/KG	ISOPROPYLBENZENE
15.U	UG/KG	N-PROPYLBENZENE
15.U	UG/KG	1,3,5-TRIMETHYLBENZENE
15.U	UG/KG	TERT-BUTYLBENZENE
5.2J	UG/KG	1,2,4-TRIMETHYLBENZENE
15.U	UG/KG	SEC-BUTYLBENZENE
15.U	UG/KG	P-ISOPROPYLTOLUENE
15.U	UG/KG	N-BUTYLBENZENE
15.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
15.U	UG/KG	1,2,4-TRICHLOROBENZENE
15.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
15.U	UG/KG	1,2,3-TRICHLOROBENZENE
31.2	%	% MOISTURE

page value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

val value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification.

1. 姓名		2. 性别		3. 年龄		4. 民族		5. 籍贯		6. 出生地		7. 学历		8. 学位		9. 职称		10. 职务		11. 工作单位		12. 联系电话		13. 电子邮箱		14. 其他	
1. 姓名	2. 性别	3. 年龄	4. 民族	5. 籍贯	6. 出生地	7. 学历	8. 学位	9. 职称	10. 职务	11. 工作单位	12. 联系电话	13. 电子邮箱	14. 其他	1. 姓名	2. 性别	3. 年龄	4. 民族	5. 籍贯	6. 出生地	7. 学历	8. 学位	9. 职称	10. 职务	11. 工作单位	12. 联系电话	13. 电子邮箱	14. 其他

Sample 2374 FY 1998 Project: 98-0241

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

MISCELLANEOUS COMPOUNDS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: REM1

Media: SEDIM

RESULTS UNITS ANALYTE

90JN UG/KG INDANE

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit.
nc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification.
continued by spurs. If spurs are added to report, see comments on data. 2. Comments on Volatiles of Type 1 and 2 by

Sample 2375 FY 1998 Project: 98-0241

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

VOLATILES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: REM2

Media: SEDIM

RESULTS	UNITS	ANALYTE
110.U	UG/KG	TRICHLOROFLUOROMETHANE
110.U	UG/KG	CHLOROMETHANE
110.U	UG/KG	BROMOMETHANE
110.U	UG/KG	VINYL CHLORIDE
110.U	UG/KG	CHLOROETHANE
570.U	UG/KG	METHYLENE CHLORIDE
110.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)
5300J	UG/KG	ACETONE
290.U	UG/KG	CARBON DISULFIDE
110.U	UG/KG	1,1-DICHLOROETHANE
110.U	UG/KG	CIS-1,2-DICHLOROETHENE
110.U	UG/KG	2,2-DICHLOROPROPANE
2900.U	UG/KG	METHYL ETHYL KETONE
110.U	UG/KG	BROMOCHLOROMETHANE
110.U	UG/KG	TRANS-1,2-DICHLOROETHENE
110.U	UG/KG	CHLOROFORM
110.U	UG/KG	1,2-DICHLOROETHANE
110.U	UG/KG	1,1,1-TRICHLOROETHANE
110.U	UG/KG	1,1-DICHLOROPROPENE
110.U	UG/KG	CARBON TETRACHLORIDE
110.U	UG/KG	BROMODICHLOROMETHANE
290.U	UG/KG	METHYL ISOBUTYL KETONE
110.U	UG/KG	1,2-DICHLOROPROPANE
110.U	UG/KG	DIBROMOMETHANE
110.U	UG/KG	TRANS-1,3-DICHLOROPROPENE
110.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)
110.U	UG/KG	BENZENE
110.U	UG/KG	DIBROMOCHLOROMETHANE
110.U	UG/KG	1,1,2-TRICHLOROETHANE
110.U	UG/KG	CIS-1,3-DICHLOROPROPENE
110.U	UG/KG	BROMOFORM
110.U	UG/KG	BROMOBENZENE
110.U	UG/KG	1,1,2,2-TETRACHLOROETHANE
110.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)
110.U	UG/KG	1,3-DICHLOROPROPANE
290.U	UG/KG	METHYL BUTYL KETONE
110.U	UG/KG	TOLUENE
730.	UG/KG	CHLOROBENZENE

RESULTS	UNITS	ANALYTE
110.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
30.J	UG/KG	ETHYL BENZENE
81.J	UG/KG	(M- AND/OR P-)XYLENE
41.J	UG/KG	O-XYLENE
110.U	UG/KG	STYRENE
110.U	UG/KG	1,2,3-TRICHLOROPROPANE
110.J	UG/KG	O-CHLOROTOLUENE
57.J	UG/KG	P-CHLOROTOLUENE
65.J	UG/KG	1,3-DICHLOROBENZENE
280.	UG/KG	1,4-DICHLOROBENZENE
72.J	UG/KG	1,2-DICHLOROBENZENE
110.U	UG/KG	1,2-DIBROMOETHANE (EDB)
110.U	UG/KG	ISOPROPYLBENZENE
110.U	UG/KG	N-PROPYLBENZENE
72.J	UG/KG	1,3,5-TRIMETHYLBENZENE
110.U	UG/KG	TERT-BUTYLBENZENE
130.	UG/KG	1,2,4-TRIMETHYLBENZENE
110.U	UG/KG	SEC-BUTYLBENZENE
110.U	UG/KG	P-ISOPROPYLTOLUENE
110.U	UG/KG	N-BUTYLBENZENE
110.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
72.J	UG/KG	1,2,4-TRICHLOROBENZENE
110.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
53.J	UG/KG	1,2,3-TRICHLOROBENZENE
20.7	%	% MOISTURE

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit
or indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

confirmed by GC/MS. 1 when no value is reported. See maximum concentrations of constituents in table below for detection limits.

LATILES SAMPLE ANALYSIS**EPA - REGION IV SEDS, ATHENS, GA****Production Date: 03/11/98 15:49**Sample **2375** FY **1998** Project **98-0241****MISCELLANEOUS COMPOUNDS**

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: REM2

Media: SEDIM

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
1000JN	UG/KG	INDANE

Average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

L-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit.

indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification.

This data was collected on 03/11/98 for EPA Region IV, Athens, GA. The data was collected for the purpose of monitoring the quality of the sediment in the Tennessee River.

OLATILES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/11/98 15:49

Sample 2376 FY 1998 Project: 98-0241

Produced by: Frank Allen

VOLATILES SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning 02/13/98

Id/Station: ACTR

Ending:

Media: SEDIM

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
100.U	UG/KG	TRICHLOROFLUOROMETHANE
100.U	UG/KG	CHLOROMETHANE
100.U	UG/KG	BROMOMETHANE
100.U	UG/KG	VINYL CHLORIDE
100.U	UG/KG	CHLOROETHANE
500.U	UG/KG	METHYLENE CHLORIDE
100.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)
19000.J	UG/KG	ACETONE
250.U	UG/KG	CARBON DISULFIDE
100.U	UG/KG	1,1-DICHLOROETHANE
100.U	UG/KG	CIS-1,2-DICHLOROETHENE
100.U	UG/KG	2,2-DICHLOROPROPANE
2500.U	UG/KG	METHYL ETHYL KETONE
100.U	UG/KG	BROMOCHLOROMETHANE
100.U	UG/KG	TRANS-1,2-DICHLOROETHENE
100.U	UG/KG	CHLOROFORM
100.U	UG/KG	1,2-DICHLOROETHANE
100.U	UG/KG	1,1,1-TRICHLOROETHANE
100.U	UG/KG	1,1-DICHLOROPROPENE
100.U	UG/KG	CARBON TETRACHLORIDE
100.U	UG/KG	BROMODICHLOROMETHANE
250.U	UG/KG	METHYL ISOBUTYL KETONE
100.U	UG/KG	1,2-DICHLOROPROPANE
100.U	UG/KG	DIBROMOMETHANE
100.U	UG/KG	TRANS-1,3-DICHLOROPROPENE
100.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)
100.U	UG/KG	BENZENE
100.U	UG/KG	DIBROMOCHLOROMETHANE
100.U	UG/KG	1,1,2-TRICHLOROETHANE
100.U	UG/KG	CIS-1,3-DICHLOROPROPENE
100.U	UG/KG	BROMOFORM
100.U	UG/KG	BROMOBENZENE
100.U	UG/KG	1,1,2,2-TETRACHLOROETHANE
100.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)
100.U	UG/KG	1,3-DICHLOROPROPANE
250.U	UG/KG	METHYL BUTYL KETONE
100.U	UG/KG	TOLUENE
48.J	UG/KG	CHLOROBENZENE

RESULTS	UNITS	ANALYTE
100.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
100.U	UG/KG	ETHYL BENZENE
100.U	UG/KG	(M- AND/OR P-)XYLENE
100.U	UG/KG	O-XYLENE
100.U	UG/KG	STYRENE
100.U	UG/KG	1,2,3-TRICHLOROPROPANE
100.U	UG/KG	O-CHLOROTOLUENE
100.U	UG/KG	P-CHLOROTOLUENE
100.U	UG/KG	1,3-DICHLOROBENZENE
55.J	UG/KG	1,4-DICHLOROBENZENE
100.U	UG/KG	1,2-DICHLOROBENZENE
100.U	UG/KG	1,2-DIBROMOETHANE (EDB)
100.U	UG/KG	ISOPROPYLBENZENE
100.U	UG/KG	N-PROPYLBENZENE
100.U	UG/KG	1,3,5-TRIMETHYLBENZENE
100.U	UG/KG	TERT-BUTYLBENZENE
100.U	UG/KG	1,2,4-TRIMETHYLBENZENE
100.U	UG/KG	SEC-BUTYLBENZENE
100.U	UG/KG	P-ISOPROPYLTOLUENE
100.U	UG/KG	N-BUTYLBENZENE
100.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
50.J	UG/KG	1,2,4-TRICHLOROBENZENE
100.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
100.U	UG/KG	1,2,3-TRICHLOROBENZENE
29.5	%	% MOISTURE

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit.

* indicates that data unusable compound may or may not be present. resampling and reanalysis is necessary for verification.

SAMPLED BY: [redacted] ANALYZED BY: [redacted] DATE: 03/11/98

VOLATILES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/11/98 15:49

Sample **2377** FY **1998** Project **98-0241**

VOLATILES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station:REFERENCE SOIL

Media: SOIL

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE	RESULTS	UNITS	ANALYTE
13.U	UG/KG	TRICHLOROFLUOROMETHANE	13.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
13.U	UG/KG	CHLOROMETHANE	13.U	UG/KG	ETHYL BENZENE
13.U	UG/KG	BROMOMETHANE	13.U	UG/KG	(M- AND/OR P-)XYLENE
13.U	UG/KG	VINYL CHLORIDE	13.U	UG/KG	O-XYLENE
13.U	UG/KG	CHLOROETHANE	13.U	UG/KG	STYRENE
65.U	UG/KG	METHYLENE CHLORIDE	13.U	UG/KG	1,2,3-TRICHLOROPROPANE
13.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)	13.U	UG/KG	O-CHLOROTOLUENE
320.U	UG/KG	ACETONE	13.U	UG/KG	P-CHLOROTOLUENE
32.U	UG/KG	CARBON DISULFIDE	13.U	UG/KG	1,3-DICHLOROBENZENE
13.U	UG/KG	1,1-DICHLOROETHANE	13.U	UG/KG	1,4-DICHLOROBENZENE
13.U	UG/KG	CIS-1,2-DICHLOROETHENE	13.U	UG/KG	1,2-DICHLOROBENZENE
13.U	UG/KG	2,2-DICHLOROPROPANE	13.U	UG/KG	1,2-DIBROMOETHANE (EDB)
320.U	UG/KG	METHYL ETHYL KETONE	13.U	UG/KG	ISOPROPYLBENZENE
13.U	UG/KG	BROMOCHLOROMETHANE	13.U	UG/KG	N-PROPYLBENZENE
13.U	UG/KG	TRANS-1,2-DICHLOROETHENE	13.U	UG/KG	1,3,5-TRIMETHYLBENZENE
13.U	UG/KG	CHLOROFORM	13.U	UG/KG	TERT-BUTYLBENZENE
13.U	UG/KG	1,2-DICHLOROETHANE	13.U	UG/KG	1,2,4-TRIMETHYLBENZENE
13.U	UG/KG	1,1,1-TRICHLOROETHANE	13.U	UG/KG	SEC-BUTYLBENZENE
13.U	UG/KG	1,1-DICHLOROPROPENE	13.U	UG/KG	P-ISOPROPYLTOLUENE
13.U	UG/KG	CARBON TETRACHLORIDE	13.U	UG/KG	N-BUTYLBENZENE
13.U	UG/KG	BROMODICHLOROMETHANE	13.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
32.U	UG/KG	METHYL ISOBUTYL KETONE	13.U	UG/KG	1,2,4-TRICHLOROBENZENE
13.U	UG/KG	1,2-DICHLOROPROPANE	13.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
13.U	UG/KG	DIBROMOMETHANE	13.U	UG/KG	1,2,3-TRICHLOROBENZENE
13.U	UG/KG	TRANS-1,3-DICHLOROPROPENE	22.6	%	% MOISTURE
13.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)			
13.U	UG/KG	BENZENE			
13.U	UG/KG	DIBROMOCHLOROMETHANE			
13.U	UG/KG	1,1,2-TRICHLOROETHANE			
13.U	UG/KG	CIS-1,3-DICHLOROPROPENE			
13.U	UG/KG	BROMOFORM			
13.U	UG/KG	BROMOBENZENE			
13.U	UG/KG	1,1,2,2-TETRACHLOROETHANE			
13.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)			
13.U	UG/KG	1,3-DICHLOROPROPANE			
32.U	UG/KG	METHYL BUTYL KETONE			
13.U	UG/KG	TOLUENE			
13.U	UG/KG	CHLOROBENZENE			

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material

average value. NA-not analyzed. NAI-inferences. J-estimated value. IV-presumptive evidence of presence of material.
actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

actual value is known to be less than value given. 1-actual value is known to be greater than value given. 2-material was analyzed. qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

de indicates that data are available; compound may or may not be present; *denotes sampling area only; n.d., not detected.

VOLATILES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/11/98 15:49

Sample 2378 FY 1998 Project: 98-0241

Produced by: Frank Allen

VOLATILES SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station: S1

Ending:

Media: SOIL

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
15.U	UG/KG	TRICHLOROFLUOROMETHANE
15.U	UG/KG	CHLOROMETHANE
15.U	UG/KG	BROMOMETHANE
15.U	UG/KG	VINYL CHLORIDE
15.U	UG/KG	CHLOROETHANE
75.U	UG/KG	METHYLENE CHLORIDE
15.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)
380.U	UG/KG	ACETONE
38.U	UG/KG	CARBON DISULFIDE
15.U	UG/KG	1,1-DICHLOROETHANE
15.U	UG/KG	CIS-1,2-DICHLOROETHENE
15.U	UG/KG	2,2-DICHLOROPROPANE
380.U	UG/KG	METHYL ETHYL KETONE
15.U	UG/KG	BROMOCHLOROMETHANE
15.U	UG/KG	TRANS-1,2-DICHLOROETHENE
15.U	UG/KG	CHLOROFORM
15.U	UG/KG	1,2-DICHLOROETHANE
15.U	UG/KG	1,1,1-TRICHLOROETHANE
15.U	UG/KG	1,1-DICHLOROPROPENE
15.U	UG/KG	CARBON TETRACHLORIDE
15.U	UG/KG	BROMODICHLOROMETHANE
38.U	UG/KG	METHYL ISOBUTYL KETONE
15.U	UG/KG	1,2-DICHLOROPROPANE
15.U	UG/KG	DIBROMOMETHANE
15.U	UG/KG	TRANS-1,3-DICHLOROPROPENE
15.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)
15.U	UG/KG	BENZENE
15.U	UG/KG	DIBROMOCHLOROMETHANE
15.U	UG/KG	1,1,2-TRICHLOROETHANE
15.U	UG/KG	CIS-1,3-DICHLOROPROPENE
15.U	UG/KG	BROMOFORM
15.U	UG/KG	BROMOBENZENE
15.U	UG/KG	1,1,2,2-TETRACHLOROETHANE
15.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)
15.U	UG/KG	1,3-DICHLOROPROPANE
38.U	UG/KG	METHYL BUTYL KETONE
15.U	UG/KG	TOLUENE
15.U	UG/KG	CHLOROBENZENE

RESULTS	UNITS	ANALYTE
15.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
15.U	UG/KG	ETHYL BENZENE
15.U	UG/KG	(M- AND/OR P-)XYLENE
15.U	UG/KG	O-XYLENE
15.U	UG/KG	STYRENE
15.U	UG/KG	1,2,3-TRICHLOROPROPANE
15.U	UG/KG	O-CHLOROTOLUENE
15.U	UG/KG	P-CHLOROTOLUENE
15.U	UG/KG	1,3-DICHLOROBENZENE
15.U	UG/KG	1,4-DICHLOROBENZENE
15.U	UG/KG	1,2-DICHLOROBENZENE
15.U	UG/KG	1,2-DIBROMOETHANE (EDB)
15.U	UG/KG	ISOPROPYLBENZENE
15.U	UG/KG	N-PROPYLBENZENE
15.U	UG/KG	1,3,5-TRIMETHYLBENZENE
15.U	UG/KG	TERT-BUTYLBENZENE
15.U	UG/KG	1,2,4-TRIMETHYLBENZENE
15.U	UG/KG	SEC-BUTYLBENZENE
15.U	UG/KG	P-ISOPROPYLTOLUENE
15.U	UG/KG	N-BUTYLBENZENE
15.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
15.U	UG/KG	1,2,4-TRICHLOROBENZENE
15.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
15.U	UG/KG	1,2,3-TRICHLOROBENZENE
33.4	%	% MOISTURE

Average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

Actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit

D indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

Reported by: g. r. s. Date: 03/11/98

VOLATILES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/11/98 15:49

Sample 2379 FY 1998 Project: 98-0241

Produced by: Frank Allen

VOLATILES SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station: S2

Ending:

Media: SOIL

Information on detection limits shortly

RESULTS	UNITS	ANALYTE	RESULTS	UNITS	ANALYTE
11.U	UG/KG	TRICHLOROFLUOROMETHANE	11.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
11.U	UG/KG	CHLOROMETHANE	11.U	UG/KG	ETHYL BENZENE
11.U	UG/KG	BROMOMETHANE	11.U	UG/KG	(M- AND/OR P-)XYLENE
11.U	UG/KG	VINYL CHLORIDE	11.U	UG/KG	O-XYLENE
11.U	UG/KG	CHLOROETHANE	11.U	UG/KG	STYRENE
56.U	UG/KG	METHYLENE CHLORIDE	11.U	UG/KG	1,2,3-TRICHLOROPROPANE
11.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)	11.U	UG/KG	O-CHLOROTOLUENE
280.U	UG/KG	ACETONE	11.U	UG/KG	P-CHLOROTOLUENE
28.U	UG/KG	CARBON DISULFIDE	11.U	UG/KG	1,3-DICHLOROBENZENE
11.U	UG/KG	1,1-DICHLOROETHANE	11.U	UG/KG	1,4-DICHLOROBENZENE
11.U	UG/KG	CIS-1,2-DICHLOROETHENE	11.U	UG/KG	1,2-DICHLOROBENZENE
11.U	UG/KG	2,2-DICHLOROPROPANE	11.U	UG/KG	1,2-DIBROMOETHANE (EDB)
280.U	UG/KG	METHYL ETHYL KETONE	11.U	UG/KG	ISOPROPYLBENZENE
11.U	UG/KG	BROMOCHLOROMETHANE	11.U	UG/KG	N-PROPYLBENZENE
11.U	UG/KG	TRANS-1,2-DICHLOROETHENE	11.U	UG/KG	1,3,5-TRIMETHYLBENZENE
11.U	UG/KG	CHLOROFORM	11.U	UG/KG	TERT-BUTYLBENZENE
11.U	UG/KG	1,2-DICHLOROETHANE	11.U	UG/KG	1,2,4-TRIMETHYLBENZENE
11.U	UG/KG	1,1,1-TRICHLOROETHANE	11.U	UG/KG	SEC-BUTYLBENZENE
11.U	UG/KG	1,1-DICHLOROPROPENE	11.U	UG/KG	P-ISOPROPYLTOLUENE
11.U	UG/KG	CARBON TETRACHLORIDE	11.U	UG/KG	N-BUTYLBENZENE
11.U	UG/KG	BROMODICHLOROMETHANE	11.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
28.U	UG/KG	METHYL ISOBUTYL KETONE	11.U	UG/KG	1,2,4-TRICHLOROBENZENE
11.U	UG/KG	1,2-DICHLOROPROPANE	11.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
11.U	UG/KG	DIBROMOMETHANE	11.U	UG/KG	1,2,3-TRICHLOROBENZENE
11.U	UG/KG	TRANS-1,3-DICHLOROPROPENE	19.3	%	% MOISTURE
11.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)			
11.U	UG/KG	BENZENE			
11.U	UG/KG	DIBROMOCHLOROMETHANE			
11.U	UG/KG	1,1,2-TRICHLOROETHANE			
11.U	UG/KG	CIS-1,3-DICHLOROPROPENE			
11.U	UG/KG	BROMOFORM			
11.U	UG/KG	BROMOBENZENE			
11.U	UG/KG	1,1,2,2-TETRACHLOROETHANE			
11.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)			
11.U	UG/KG	1,3-DICHLOROPROPANE			
28.U	UG/KG	METHYL BUTYL KETONE			
11.U	UG/KG	TOLUENE			
11.U	UG/KG	CHLOROBENZENE			

Average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit. indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

VOLATILES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/11/98 15:49

Sample 2380 FY 1998 Project: 98-0241

Produced by: Frank Allen

VOLATILES SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station: S3

Ending:

Media: SOIL

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
16.U	UG/KG	TRICHLOROFLUOROMETHANE
16.U	UG/KG	CHLOROMETHANE
16.U	UG/KG	BROMOMETHANE
16.U	UG/KG	VINYL CHLORIDE
16.U	UG/KG	CHLOROETHANE
80.U	UG/KG	METHYLENE CHLORIDE
16.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)
330.J	UG/KG	ACETONE
40.U	UG/KG	CARBON DISULFIDE
16.U	UG/KG	1,1-DICHLOROETHANE
16.U	UG/KG	CIS-1,2-DICHLOROETHENE
16.U	UG/KG	2,2-DICHLOROPROPANE
400.U	UG/KG	METHYL ETHYL KETONE
16.U	UG/KG	BROMOCHLOROMETHANE
16.U	UG/KG	TRANS-1,2-DICHLOROETHENE
16.U	UG/KG	CHLOROFORM
16.U	UG/KG	1,2-DICHLOROETHANE
16.U	UG/KG	1,1,1-TRICHLOROETHANE
16.U	UG/KG	1,1-DICHLOROPROPENE
16.U	UG/KG	CARBON TETRACHLORIDE
16.U	UG/KG	BROMODICHLOROMETHANE
40.U	UG/KG	METHYL ISOBUTYL KETONE
16.U	UG/KG	1,2-DICHLOROPROPANE
16.U	UG/KG	DIBROMOMETHANE
16.U	UG/KG	TRANS-1,3-DICHLOROPROPENE
16.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)
16.U	UG/KG	BENZENE
16.U	UG/KG	DIBROMOCHLOROMETHANE
16.U	UG/KG	1,1,2-TRICHLOROETHANE
16.U	UG/KG	CIS-1,3-DICHLOROPROPENE
16.U	UG/KG	BROMOFORM
16.U	UG/KG	BROMOBENZENE
16.U	UG/KG	1,1,2,2-TETRACHLOROETHANE
16.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)
16.U	UG/KG	1,3-DICHLOROPROPANE
40.U	UG/KG	METHYL BUTYL KETONE
16.U	UG/KG	TOLUENE
16.U	UG/KG	CHLOROBENZENE

RESULTS	UNITS	ANALYTE
16.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
16.U	UG/KG	ETHYL BENZENE
16.U	UG/KG	(M- AND/OR P-)XYLENE
16.U	UG/KG	O-XYLENE
16.U	UG/KG	STYRENE
16.U	UG/KG	1,2,3-TRICHLOROPROPANE
16.U	UG/KG	O-CHLOROTOLUENE
16.U	UG/KG	P-CHLOROTOLUENE
16.U	UG/KG	1,3-DICHLOROBENZENE
16.U	UG/KG	1,4-DICHLOROBENZENE
16.U	UG/KG	1,2-DICHLOROBENZENE
16.U	UG/KG	1,2-DIBROMOETHANE (EDB)
16.U	UG/KG	ISOPROPYLBENZENE
16.U	UG/KG	N-PROPYLBENZENE
16.U	UG/KG	1,3,5-TRIMETHYLBENZENE
16.U	UG/KG	TERT-BUTYLBENZENE
16.U	UG/KG	1,2,4-TRIMETHYLBENZENE
16.U	UG/KG	SEC-BUTYLBENZENE
16.U	UG/KG	P-ISOPROPYLTOLUENE
16.U	UG/KG	N-BUTYLBENZENE
16.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
16.U	UG/KG	1,2,4-TRICHLOROBENZENE
16.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
16.U	UG/KG	1,2,3-TRICHLOROBENZENE
43.1	%	% MOISTURE

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

L-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

? indicates that data unusable compound may or may not be present. resampling and reanalysis is necessary for verification.

Sample 2381 FY 1998 Project: 98-0241

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

VOLATILES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S4

Media: SOIL

RESULTS	UNITS	ANALYTE
16.U	UG/KG	TRICHLOROFLUOROMETHANE
16.U	UG/KG	CHLOROMETHANE
16.U	UG/KG	BROMOMETHANE
16.U	UG/KG	VINYL CHLORIDE
16.U	UG/KG	CHLOROETHANE
82.U	UG/KG	METHYLENE CHLORIDE
16.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)
410.U	UG/KG	ACETONE
41.U	UG/KG	CARBON DISULFIDE
16.U	UG/KG	1,1-DICHLOROETHANE
16.U	UG/KG	CIS-1,2-DICHLOROETHENE
16.U	UG/KG	2,2-DICHLOROPROPANE
410.U	UG/KG	METHYL ETHYL KETONE
16.U	UG/KG	BROMOCHLOROMETHANE
16.U	UG/KG	TRANS-1,2-DICHLOROETHENE
16.U	UG/KG	CHLOROFORM
16.U	UG/KG	1,2-DICHLOROETHANE
16.U	UG/KG	1,1,1-TRICHLOROETHANE
16.U	UG/KG	1,1-DICHLOROPROPENE
16.U	UG/KG	CARBON TETRACHLORIDE
16.U	UG/KG	BROMODICHLOROMETHANE
41.U	UG/KG	METHYL ISOBUTYL KETONE
16.U	UG/KG	1,2-DICHLOROPROPANE
16.U	UG/KG	DIBROMOMETHANE
16.U	UG/KG	TRANS-1,3-DICHLOROPROPENE
16.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)
16.U	UG/KG	BENZENE
16.U	UG/KG	DIBROMOCHLOROMETHANE
16.U	UG/KG	1,1,2-TRICHLOROETHANE
16.U	UG/KG	CIS-1,3-DICHLOROPROPENE
16.U	UG/KG	BROMOFORM
16.U	UG/KG	BROMOBENZENE
16.U	UG/KG	1,1,2,2-TETRACHLOROETHANE
16.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)
16.U	UG/KG	1,3-DICHLOROPROPANE
41.U	UG/KG	METHYL BUTYL KETONE
16.U	UG/KG	TOLUENE
16.U	UG/KG	CHLOROBENZENE

RESULTS	UNITS	ANALYTE
16.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
16.U	UG/KG	ETHYL BENZENE
16.U	UG/KG	(M- AND/OR P-)XYLENE
16.U	UG/KG	O-XYLENE
16.U	UG/KG	STYRENE
16.U	UG/KG	1,2,3-TRICHLOROPROPANE
16.U	UG/KG	O-CHLOROTOLUENE
16.U	UG/KG	P-CHLOROTOLUENE
16.U	UG/KG	1,3-DICHLOROBENZENE
16.U	UG/KG	1,4-DICHLOROBENZENE
16.U	UG/KG	1,2-DICHLOROBENZENE
16.U	UG/KG	1,2-DIBROMOETHANE (EDB)
16.U	UG/KG	ISOPROPYLBENZENE
16.U	UG/KG	N-PROPYLBENZENE
16.U	UG/KG	1,3,5-TRIMETHYLBENZENE
16.U	UG/KG	TERT-BUTYLBENZENE
16.U	UG/KG	1,2,4-TRIMETHYLBENZENE
16.U	UG/KG	SEC-BUTYLBENZENE
16.U	UG/KG	P-ISOPROPYLTOLUENE
16.U	UG/KG	N-BUTYLBENZENE
16.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
16.U	UG/KG	1,2,4-TRICHLOROBENZENE
16.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
16.U	UG/KG	1,2,3-TRICHLOROBENZENE
38.7	%	% MOISTURE

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit
qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

revised by g. j. j. 11/11/98 11:11:11 AM 11/11/98 11:11:11 AM 11/11/98 11:11:11 AM 11/11/98 11:11:11 AM 11/11/98 11:11:11 AM

VOLATILES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/11/98 15:49

Sample 2382 FY 1998 Project: 98-0241

VOLATILES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S5

Media: SOIL

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE	RESULTS	UNITS	ANALYTE
19.U	UG/KG	TRICHLOROFLUOROMETHANE	19.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
19.U	UG/KG	CHLOROMETHANE	19.U	UG/KG	ETHYL BENZENE
19.U	UG/KG	BROMOMETHANE	19.U	UG/KG	(M- AND/OR P-)XYLENE
19.U	UG/KG	VINYL CHLORIDE	19.U	UG/KG	O-XYLENE
19.U	UG/KG	CHLOROETHANE	19.U	UG/KG	STYRENE
95.U	UG/KG	METHYLENE CHLORIDE	19.U	UG/KG	1,2,3-TRICHLOROPROPANE
19.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)	19.U	UG/KG	O-CHLOROTOLUENE
2800.J	UG/KG	ACETONE	19.U	UG/KG	P-CHLOROTOLUENE
47.U	UG/KG	CARBON DISULFIDE	19.U	UG/KG	1,3-DICHLOROBENZENE
19.U	UG/KG	1,1-DICHLOROETHANE	19.U	UG/KG	1,4-DICHLOROBENZENE
19.U	UG/KG	CIS-1,2-DICHLOROETHENE	19.U	UG/KG	1,2-DICHLOROBENZENE
19.U	UG/KG	2,2-DICHLOROPROPANE	19.U	UG/KG	1,2-DIBROMOETHANE (EDB)
470.U	UG/KG	METHYL ETHYL KETONE	19.U	UG/KG	ISOPROPYLBENZENE
19.U	UG/KG	BROMOCHLOROMETHANE	19.U	UG/KG	N-PROPYLBENZENE
19.U	UG/KG	TRANS-1,2-DICHLOROETHENE	19.U	UG/KG	1,3,5-TRIMETHYLBENZENE
19.U	UG/KG	CHLOROFORM	19.U	UG/KG	TERT-BUTYLBENZENE
19.U	UG/KG	1,2-DICHLOROETHANE	19.U	UG/KG	1,2,4-TRIMETHYLBENZENE
19.U	UG/KG	1,1,1-TRICHLOROETHANE	19.U	UG/KG	SEC-BUTYLBENZENE
19.U	UG/KG	1,1-DICHLOROPROPENE	19.U	UG/KG	P-ISOPROPYLTOLUENE
19.U	UG/KG	CARBON TETRACHLORIDE	19.U	UG/KG	N-BUTYLBENZENE
19.U	UG/KG	BROMODICHLOROMETHANE	19.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
47.U	UG/KG	METHYL ISOBUTYL KETONE	19.U	UG/KG	1,2,4-TRICHLOROBENZENE
19.U	UG/KG	1,2-DICHLOROPROPANE	19.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
19.U	UG/KG	DIBROMOMETHANE	19.U	UG/KG	1,2,3-TRICHLOROBENZENE
19.U	UG/KG	TRANS-1,3-DICHLOROPROPENE	34.0	%	% MOISTURE
19.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)			
19.U	UG/KG	BENZENE			
19.U	UG/KG	DIBROMOCHLOROMETHANE			
19.U	UG/KG	1,1,2-TRICHLOROETHANE			
19.U	UG/KG	CIS-1,3-DICHLOROPROPENE			
19.U	UG/KG	BROMOFORM			
19.U	UG/KG	BROMOBENZENE			
19.U	UG/KG	1,1,2,2-TETRACHLOROETHANE			
19.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)			
19.U	UG/KG	1,3-DICHLOROPROPANE			
47.U	UG/KG	METHYL BUTYL KETONE			
19.U	UG/KG	TOLUENE			
19.U	UG/KG	CHLOROBENZENE			

Average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

L-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit.

qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Sample 2382 FY 1998 Project: 98-0241

VOLATILES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/11/98 15:49

Sample 2383 FY 1998 Project: 98-0241

VOLATILES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: STA

Media: SOIL

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
2100.U	UG/KG	TRICHLOROFLUOROMETHANE
2100.U	UG/KG	CHLOROMETHANE
2100.U	UG/KG	BROMOMETHANE
2100.U	UG/KG	VINYL CHLORIDE
2100.U	UG/KG	CHLOROETHANE
11000.U	UG/KG	METHYLENE CHLORIDE
2100.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)
72000.	UG/KG	ACETONE
5300.U	UG/KG	CARBON DISULFIDE
2100.U	UG/KG	1,1-DICHLOROETHANE
2100.U	UG/KG	CIS-1,2-DICHLOROETHENE
2100.U	UG/KG	2,2-DICHLOROPROPANE
53000.U	UG/KG	METHYL ETHYL KETONE
2100.U	UG/KG	BROMOCHLOROMETHANE
2100.U	UG/KG	TRANS-1,2-DICHLOROETHENE
2100.U	UG/KG	CHLOROFORM
2100.U	UG/KG	1,2-DICHLOROETHANE
2100.U	UG/KG	1,1,1-TRICHLOROETHANE
2100.U	UG/KG	1,1-DICHLOROPROPENE
2100.U	UG/KG	CARBON TETRACHLORIDE
2100.U	UG/KG	BROMODICHLOROMETHANE
5300.U	UG/KG	METHYL ISOBUTYL KETONE
2100.U	UG/KG	1,2-DICHLOROPROPANE
2100.U	UG/KG	DIBROMOMETHANE
2100.U	UG/KG	TRANS-1,3-DICHLOROPROPENE
2100.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)
2100.U	UG/KG	BENZENE
2100.U	UG/KG	DIBROMOCHLOROMETHANE
2100.U	UG/KG	1,1,2-TRICHLOROETHANE
2100.U	UG/KG	CIS-1,3-DICHLOROPROPENE
2100.U	UG/KG	BROMOFORM
2100.U	UG/KG	BROMOBENZENE
2100.U	UG/KG	1,1,2,2-TETRACHLOROETHANE
2100.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)
2100.U	UG/KG	1,3-DICHLOROPROPANE
5300.U	UG/KG	METHYL BUTYL KETONE
2100.U	UG/KG	TOLUENE
2100.U	UG/KG	CHLOROBENZENE

RESULTS	UNITS	ANALYTE
2100.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
2100.U	UG/KG	ETHYL BENZENE
2100.U	UG/KG	(M- AND/OR P-)XYLENE
2100.U	UG/KG	O-XYLENE
2100.U	UG/KG	STYRENE
2100.U	UG/KG	1,2,3-TRICHLOROPROPANE
2100.U	UG/KG	O-CHLOROTOLUENE
2100.U	UG/KG	P-CHLOROTOLUENE
2100.U	UG/KG	1,3-DICHLOROBENZENE
2100.U	UG/KG	1,4-DICHLOROBENZENE
2100.U	UG/KG	1,2-DICHLOROBENZENE
2100.U	UG/KG	1,2-DIBROMOETHANE (EDB)
2100.U	UG/KG	ISOPROPYLBENZENE
2100.U	UG/KG	N-PROPYLBENZENE
2100.U	UG/KG	1,3,5-TRIMETHYLBENZENE
2100.U	UG/KG	TERT-BUTYLBENZENE
2100.U	UG/KG	1,2,4-TRIMETHYLBENZENE
2100.U	UG/KG	SEC-BUTYLBENZENE
2100.U	UG/KG	P-ISOPROPYLTOLUENE
2100.U	UG/KG	N-BUTYLBENZENE
2100.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
2100.U	UG/KG	1,2,4-TRICHLOROBENZENE
2100.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
2100.U	UG/KG	1,2,3-TRICHLOROBENZENE
21.4	%	% MOISTURE

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

no indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

VOLATILES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/11/98 15:49

Sample 2384 FY 1998 Project: 98-0241

VOLATILES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: REFERENCE

Media: SEDIM

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE	RESULTS	UNITS	ANALYTE
13.U	UG/KG	TRICHLOROFLUOROMETHANE	13.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
13.U	UG/KG	CHLOROMETHANE	13.U	UG/KG	ETHYL BENZENE
13.U	UG/KG	BROMOMETHANE	13.U	UG/KG	(M- AND/OR P-)XYLENE
13.U	UG/KG	VINYL CHLORIDE	13.U	UG/KG	O-XYLENE
13.U	UG/KG	CHLOROETHANE	13.U	UG/KG	STYRENE
64.U	UG/KG	METHYLENE CHLORIDE	13.U	UG/KG	1,2,3-TRICHLOROPROPANE
13.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)	13.U	UG/KG	O-CHLOROTOLUENE
320.U	UG/KG	ACETONE	13.U	UG/KG	P-CHLOROTOLUENE
32.U	UG/KG	CARBON DISULFIDE	13.U	UG/KG	1,3-DICHLOROBENZENE
13.U	UG/KG	1,1-DICHLOROETHANE	13.U	UG/KG	1,4-DICHLOROBENZENE
13.U	UG/KG	CIS-1,2-DICHLOROETHENE	13.U	UG/KG	1,2-DICHLOROBENZENE
13.U	UG/KG	2,2-DICHLOROPROPANE	13.U	UG/KG	1,2-DIBROMOETHANE (EDB)
320.U	UG/KG	METHYL ETHYL KETONE	13.U	UG/KG	ISOPROPYLBENZENE
13.U	UG/KG	BROMOCHLOROMETHANE	13.U	UG/KG	N-PROPYLBENZENE
13.U	UG/KG	TRANS-1,2-DICHLOROETHENE	13.U	UG/KG	1,3,5-TRIMETHYLBENZENE
13.U	UG/KG	CHLOROFORM	13.U	UG/KG	TERT-BUTYLBENZENE
13.U	UG/KG	1,2-DICHLOROETHANE	13.U	UG/KG	1,2,4-TRIMETHYLBENZENE
13.U	UG/KG	1,1,1-TRICHLOROETHANE	13.U	UG/KG	SEC-BUTYLBENZENE
13.U	UG/KG	1,1-DICHLOROPROPENE	13.U	UG/KG	P-ISOPROPYLTOLUENE
13.U	UG/KG	CARBON TETRACHLORIDE	13.U	UG/KG	N-BUTYLBENZENE
13.U	UG/KG	BROMODICHLOROMETHANE	13.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
32.U	UG/KG	METHYL ISOBUTYL KETONE	13.U	UG/KG	1,2,4-TRICHLOROBENZENE
13.U	UG/KG	1,2-DICHLOROPROPANE	13.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
13.U	UG/KG	DIBROMOMETHANE	13.U	UG/KG	1,2,3-TRICHLOROBENZENE
13.U	UG/KG	TRANS-1,3-DICHLOROPROPENE	29.0	%	% MOISTURE
13.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)			
13.U	UG/KG	BENZENE			
13.U	UG/KG	DIBROMOCHLOROMETHANE			
13.U	UG/KG	1,1,2-TRICHLOROETHANE			
13.U	UG/KG	CIS-1,3-DICHLOROPROPENE			
13.U	UG/KG	BROMOFORM			
13.U	UG/KG	BROMOBENZENE			
13.U	UG/KG	1,1,2,2-TETRACHLOROETHANE			
13.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)			
13.U	UG/KG	1,3-DICHLOROPROPANE			
32.U	UG/KG	METHYL BUTYL KETONE			
13.U	UG/KG	TOLUENE			
13.U	UG/KG	CHLOROBENZENE			

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

L-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

g indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

continued by 9804 1 when no value is reported, the detection limit applies. 2) distribution of data points is assumed normal

Production Date: 03/11/98 15:49

Produced by: Frank Allen

VOLATILES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

!/Station: 6%

Media: SEDIM

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
14.U	UG/KG	TRICHLOROFLUOROMETHANE
14.U	UG/KG	CHLOROMETHANE
14.U	UG/KG	BROMOMETHANE
14.U	UG/KG	VINYL CHLORIDE
14.U	UG/KG	CHLOROETHANE
71.U	UG/KG	METHYLENE CHLORIDE
14.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)
350.U	UG/KG	ACETONE
35.U	UG/KG	CARBON DISULFIDE
14.U	UG/KG	1,1-DICHLOROETHANE
14.U	UG/KG	CIS-1,2-DICHLOROETHENE
14.U	UG/KG	2,2-DICHLOROPROPANE
350.U	UG/KG	METHYL ETHYL KETONE
14.U	UG/KG	BROMOCHLOROMETHANE
14.U	UG/KG	TRANS-1,2-DICHLOROETHENE
14.U	UG/KG	CHLOROFORM
14.U	UG/KG	1,2-DICHLOROETHANE
14.U	UG/KG	1,1,1-TRICHLOROETHANE
14.U	UG/KG	1,1-DICHLOROPROPENE
14.U	UG/KG	CARBON TETRACHLORIDE
14.U	UG/KG	BROMODICHLOROMETHANE
35.U	UG/KG	METHYL ISOBUTYL KETONE
14.U	UG/KG	1,2-DICHLOROPROPANE
14.U	UG/KG	DIBROMOMETHANE
14.U	UG/KG	TRANS-1,3-DICHLOROPROPENE
14.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)
14.U	UG/KG	BENZENE
14.U	UG/KG	DIBROMOCHLOROMETHANE
14.U	UG/KG	1,1,2-TRICHLOROETHANE
14.U	UG/KG	CIS-1,3-DICHLOROPROPENE
14.U	UG/KG	BROMOFORM
14.U	UG/KG	BROMOBENZENE
14.U	UG/KG	1,1,2,2-TETRACHLOROETHANE
14.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)
14.U	UG/KG	1,3-DICHLOROPROPANE
35.U	UG/KG	METHYL BUTYL KETONE
14.U	UG/KG	TOLUENE
14.U	UG/KG	CHLOROBENZENE

RESULTS	UNITS	ANALYTE
14.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
14.U	UG/KG	ETHYL BENZENE
14.U	UG/KG	(M- AND/OR P-)XYLENE
14.U	UG/KG	O-XYLENE
14.U	UG/KG	STYRENE
14.U	UG/KG	1,2,3-TRICHLOROPROPANE
14.U	UG/KG	O-CHLOROTOLUENE
14.U	UG/KG	P-CHLOROTOLUENE
14.U	UG/KG	1,3-DICHLOROBENZENE
14.U	UG/KG	1,4-DICHLOROBENZENE
14.U	UG/KG	1,2-DICHLOROBENZENE
14.U	UG/KG	1,2-DIBROMOETHANE (EDB)
14.U	UG/KG	ISOPROPYLBENZENE
14.U	UG/KG	N-PROPYLBENZENE
14.U	UG/KG	1,3,5-TRIMETHYLBENZENE
14.U	UG/KG	TERT-BUTYLBENZENE
14.U	UG/KG	1,2,4-TRIMETHYLBENZENE
14.U	UG/KG	SEC-BUTYLBENZENE
14.U	UG/KG	P-ISOPROPYLTOLUENE
14.U	UG/KG	N-BUTYLBENZENE
14.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
14.U	UG/KG	1,2,4-TRICHLOROBENZENE
14.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
14.U	UG/KG	1,2,3-TRICHLOROBENZENE
29.2	%	% MOISTURE

age value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

†L value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit

indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

VOLATILES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/11/98 15:49

Sample 2386 FY 1998 Project: 98-0241

VOLATILES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: 12%

Media: SEDIM

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE	RESULTS	UNITS	ANALYTE
14.U	UG/KG	TRICHLOROFLUOROMETHANE	14.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
14.U	UG/KG	CHLOROMETHANE	14.U	UG/KG	ETHYL BENZENE
14.U	UG/KG	BROMOMETHANE	14.U	UG/KG	(M- AND/OR P-)XYLENE
14.U	UG/KG	VINYL CHLORIDE	14.U	UG/KG	O-XYLENE
14.U	UG/KG	CHLOROETHANE	14.U	UG/KG	STYRENE
69.U	UG/KG	METHYLENE CHLORIDE	14.U	UG/KG	1,2,3-TRICHLOROPROPANE
14.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)	6.7J	UG/KG	O-CHLOROTOLUENE
340.U	UG/KG	ACETONE	14.U	UG/KG	P-CHLOROTOLUENE
34.U	UG/KG	CARBON DISULFIDE	14.U	UG/KG	1,3-DICHLOROBENZENE
14.U	UG/KG	1,1-DICHLOROETHANE	9.5J	UG/KG	1,4-DICHLOROBENZENE
14.U	UG/KG	CIS-1,2-DICHLOROETHENE	4.1J	UG/KG	1,2-DICHLOROBENZENE
14.U	UG/KG	2,2-DICHLOROPROPANE	14.U	UG/KG	1,2-DIBROMOETHANE (EDB)
340.U	UG/KG	METHYL ETHYL KETONE	14.U	UG/KG	ISOPROPYLBENZENE
14.U	UG/KG	BROMOCHLOROMETHANE	14.U	UG/KG	N-PROPYLBENZENE
14.U	UG/KG	TRANS-1,2-DICHLOROETHENE	14.U	UG/KG	1,3,5-TRIMETHYLBENZENE
14.U	UG/KG	CHLOROFORM	14.U	UG/KG	TERT-BUTYLBENZENE
14.U	UG/KG	1,2-DICHLOROETHANE	3.9J	UG/KG	1,2,4-TRIMETHYLBENZENE
14.U	UG/KG	1,1,1-TRICHLOROETHANE	14.U	UG/KG	SEC-BUTYLBENZENE
14.U	UG/KG	1,1-DICHLOROPROPENE	14.U	UG/KG	P-ISOPROPYLTOLUENE
14.U	UG/KG	CARBON TETRACHLORIDE	14.U	UG/KG	N-BUTYLBENZENE
14.U	UG/KG	BROMODICHLOROMETHANE	14.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
34.U	UG/KG	METHYL ISOBUTYL KETONE	14.U	UG/KG	1,2,4-TRICHLOROBENZENE
14.U	UG/KG	1,2-DICHLOROPROPANE	14.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
14.U	UG/KG	DIBROMOMETHANE	14.U	UG/KG	1,2,3-TRICHLOROBENZENE
14.U	UG/KG	TRANS-1,3-DICHLOROPROPENE	27.1	%	% MOISTURE
14.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)			
14.U	UG/KG	BENZENE			
14.U	UG/KG	DIBROMOCHLOROMETHANE			
14.U	UG/KG	1,1,2-TRICHLOROETHANE			
14.U	UG/KG	CIS-1,3-DICHLOROPROPENE			
14.U	UG/KG	BROMOFORM			
14.U	UG/KG	BROMOBENZENE			
14.U	UG/KG	1,1,2,2-TETRACHLOROETHANE			
14.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)			
14.U	UG/KG	1,3-DICHLOROPROPANE			
34.U	UG/KG	METHYL BUTYL KETONE			
14.U	UG/KG	TOLUENE			
9.8J	UG/KG	CHLOROBENZENE			

Average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

Actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

NA indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

Method: EPA 8210.1. 100% by volume is reported. See instrument manufacturer's data sheets for capabilities of the instrument used.

OLATILES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/11/98 15:49

Sample 2386 FY 1998 Project 98-0241

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

MISCELLANEOUS COMPOUNDS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: 12%

Media: SEDIM

RESULTS UNITS ANALYTE

60JN UG/KG INDANE

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit
 indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification.

information. 1-when no value is reported, see comments column. 2-when value is outside of the range of the data.

VOLATILES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/11/98 15:49

Sample 2387 FY 1998 Project: 98-0241

VOLATILES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: 25%

Media: SEDIM

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
12.U	UG/KG	TRICHLOROFLUOROMETHANE
12.U	UG/KG	CHLOROMETHANE
12.U	UG/KG	BROMOMETHANE
12.U	UG/KG	VINYL CHLORIDE
12.U	UG/KG	CHLOROETHANE
62.U	UG/KG	METHYLENE CHLORIDE
12.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)
340.U	UG/KG	ACETONE
31.U	UG/KG	CARBON DISULFIDE
12.U	UG/KG	1,1-DICHLOROETHANE
12.U	UG/KG	CIS-1,2-DICHLOROETHENE
12.U	UG/KG	2,2-DICHLOROPROPANE
310.U	UG/KG	METHYL ETHYL KETONE
12.U	UG/KG	BROMOCHLOROMETHANE
12.U	UG/KG	TRANS-1,2-DICHLOROETHENE
12.U	UG/KG	CHLOROFORM
12.U	UG/KG	1,2-DICHLOROETHANE
12.U	UG/KG	1,1,1-TRICHLOROETHANE
12.U	UG/KG	1,1-DICHLOROPROPENE
12.U	UG/KG	CARBON TETRACHLORIDE
12.U	UG/KG	BROMODICHLOROMETHANE
31.U	UG/KG	METHYL ISOBUTYL KETONE
12.U	UG/KG	1,2-DICHLOROPROPANE
12.U	UG/KG	DIBROMOMETHANE
12.U	UG/KG	TRANS-1,3-DICHLOROPROPENE
12.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)
12.U	UG/KG	BENZENE
12.U	UG/KG	DIBROMOCHLOROMETHANE
12.U	UG/KG	1,1,2-TRICHLOROETHANE
12.U	UG/KG	CIS-1,3-DICHLOROPROPENE
12.U	UG/KG	BROMOFORM
12.U	UG/KG	BROMOBENZENE
12.U	UG/KG	1,1,2,2-TETRACHLOROETHANE
12.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)
12.U	UG/KG	1,3-DICHLOROPROPANE
31.U	UG/KG	METHYL BUTYL KETONE
12.U	UG/KG	TOLUENE
37.	UG/KG	CHLOROBENZENE

RESULTS	UNITS	ANALYTE
12.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
12.U	UG/KG	ETHYL BENZENE
12.U	UG/KG	(M- AND/OR P-)XYLENE
3.2J	UG/KG	O-XYLENE
12.U	UG/KG	STYRENE
12.U	UG/KG	1,2,3-TRICHLOROPROPANE
19.	UG/KG	O-CHLOROTOLUENE
7.6J	UG/KG	P-CHLOROTOLUENE
20.	UG/KG	1,3-DICHLOROBENZENE
43.	UG/KG	1,4-DICHLOROBENZENE
13.	UG/KG	1,2-DICHLOROBENZENE
12.U	UG/KG	1,2-DIBROMOETHANE (EDB)
12.U	UG/KG	ISOPROPYLBENZENE
12.U	UG/KG	N-PROPYLBENZENE
5.5J	UG/KG	1,3,5-TRIMETHYLBENZENE
12.U	UG/KG	TERT-BUTYLBENZENE
9.7J	UG/KG	1,2,4-TRIMETHYLBENZENE
12.U	UG/KG	SEC-BUTYLBENZENE
12.U	UG/KG	P-ISOPROPYLTOLUENE
12.U	UG/KG	N-BUTYLBENZENE
12.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
7.3J	UG/KG	1,2,4-TRICHLOROBENZENE
12.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
3.4J	UG/KG	1,2,3-TRICHLOROBENZENE
32.4	%	% MOISTURE

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
 actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit
 nc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

continued on next page. If you are using a computer, see the label for instructions. A computerized analysis of the data will be provided.

VOLATILES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/11/98 15:49

Sample 2387 FY 1998 Project 98-0241

MISCELLANEOUS COMPOUNDS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: 25%

Media: SEDIM

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
100JN	UG/KG	INDANE

ited
lue
e p

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

D-ne indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

VOLATILES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/11/98 15:49

Sample **2388** FY **1998** Project: **98-0241**

VOLATILES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: 50%

Media: SEDIM

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
14.U	UG/KG	TRICHLOROFLUOROMETHANE
14.U	UG/KG	CHLOROMETHANE
14.U	UG/KG	BROMOMETHANE
14.U	UG/KG	VINYL CHLORIDE
14.U	UG/KG	CHLOROETHANE
70.U	UG/KG	METHYLENE CHLORIDE
14.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)
350.U	UG/KG	ACETONE
35.U	UG/KG	CARBON DISULFIDE
14.U	UG/KG	1,1-DICHLOROETHANE
14.U	UG/KG	CIS-1,2-DICHLOROETHENE
14.U	UG/KG	2,2-DICHLOROPROPANE
350.U	UG/KG	METHYL ETHYL KETONE
14.U	UG/KG	BROMOCHLOROMETHANE
14.U	UG/KG	TRANS-1,2-DICHLOROETHENE
14.U	UG/KG	CHLOROFORM
14.U	UG/KG	1,2-DICHLOROETHANE
14.U	UG/KG	1,1,1-TRICHLOROETHANE
14.U	UG/KG	1,1-DICHLOROPROPENE
14.U	UG/KG	CARBON TETRACHLORIDE
14.U	UG/KG	BROMODICHLOROMETHANE
35.U	UG/KG	METHYL ISOBUTYL KETONE
14.U	UG/KG	1,2-DICHLOROPROPANE
14.U	UG/KG	DIBROMOMETHANE
14.U	UG/KG	TRANS-1,3-DICHLOROPROPENE
14.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)
14.U	UG/KG	BENZENE
14.U	UG/KG	DIBROMOCHLOROMETHANE
14.U	UG/KG	1,1,2-TRICHLOROETHANE
14.U	UG/KG	CIS-1,3-DICHLOROPROPENE
14.U	UG/KG	BROMOFORM
14.U	UG/KG	BROMOBENZENE
14.U	UG/KG	1,1,2,2-TETRACHLOROETHANE
14.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)
14.U	UG/KG	1,3-DICHLOROPROPANE
35.U	UG/KG	METHYL BUTYL KETONE
14.U	UG/KG	TOLUENE
59.	UG/KG	CHLOROENZENE

RESULTS	UNITS	ANALYTE
14.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
14.U	UG/KG	ETHYL BENZENE
4.1J	UG/KG	(M- AND/OR P-)XYLENE
4.1J	UG/KG	O-XYLENE
14.U	UG/KG	STYRENE
14.U	UG/KG	1,2,3-TRICHLOROPROPANE
24.	UG/KG	O-CHLOROTOLUENE
9.6J	UG/KG	P-CHLOROTOLUENE
25.	UG/KG	1,3-DICHLORO BENZENE
66.	UG/KG	1,4-DICHLORO BENZENE
16.	UG/KG	1,2-DICHLORO BENZENE
14.U	UG/KG	1,2-DIBROMOETHANE (EDB)
14.U	UG/KG	ISOPROPYLBENZENE
14.U	UG/KG	N-PROPYLBENZENE
5.8J	UG/KG	1,3,5-TRIMETHYLBENZENE
14.U	UG/KG	TERT-BUTYLBENZENE
11.J	UG/KG	1,2,4-TRIMETHYLBENZENE
14.U	UG/KG	SEC-BUTYLBENZENE
14.U	UG/KG	P-ISOPROPYLTOLUENE
14.U	UG/KG	N-BUTYLBENZENE
14.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
11.J	UG/KG	1,2,4-TRICHLORO BENZENE
14.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
5.1J	UG/KG	1,2,3-TRICHLORO BENZENE
35.3	%	% MOISTURE

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. S-material was analyzed. B-gc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 104

VOLATILES SAMPLE ANALYSIS

EPA - REGION IV SESD, ATHENS, GA

Production Date: 03/11/98 15:49

Sample 2388 FY 1998 Project: 98-0241

Produced by: Frank Allen

MISCELLANEOUS COMPOUNDS

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station: 50%

Ending:

Media: SEDIM

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
200JN	UG/KG	INDANE

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit
qc indicates that data unusable. compound may or may not be present resampling and reanalysis is necessary for verification

For all data, the number in parentheses following the compound name is the number of samples analyzed. The number in parentheses following the detection limit is the number of samples analyzed.

VOLATILES SAMPLE ANALYSIS

EPA - REGION IV SESD, ATHENS, GA

Production Date: 03/11/98 15:49

Sample 2389 FY 1998 Project: 98-0241

VOLATILES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: BLANK

Media: SOIL

Produced by: Frank Allen

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
10.U	UG/KG	TRICHLOROFLUOROMETHANE
10.U	UG/KG	CHLOROMETHANE
10.U	UG/KG	BROMOMETHANE
10.U	UG/KG	VINYL CHLORIDE
10.U	UG/KG	CHLOROETHANE
50.U	UG/KG	METHYLENE CHLORIDE
10.U	UG/KG	1,1-DICHLOROETHENE (1,1-DICHLOROETHYLENE)
250.U	UG/KG	ACETONE
25.U	UG/KG	CARBON DISULFIDE
10.U	UG/KG	1,1-DICHLOROETHANE
10.U	UG/KG	CIS-1,2-DICHLOROETHENE
10.U	UG/KG	2,2-DICHLOROPROPANE
250.U	UG/KG	METHYL ETHYL KETONE
10.U	UG/KG	BROMOCHLOROMETHANE
10.U	UG/KG	TRANS-1,2-DICHLOROETHENE
10.U	UG/KG	CHLOROFORM
10.U	UG/KG	1,2-DICHLOROETHANE
10.U	UG/KG	1,1,1-TRICHLOROETHANE
10.U	UG/KG	1,1-DICHLOROPROPENE
10.U	UG/KG	CARBON TETRACHLORIDE
10.U	UG/KG	BROMODICHLOROMETHANE
25.U	UG/KG	METHYL ISOBUTYL KETONE
10.U	UG/KG	1,2-DICHLOROPROPANE
10.U	UG/KG	DIBROMOMETHANE
10.U	UG/KG	TRANS-1,3-DICHLOROPROPENE
10.U	UG/KG	TRICHLOROETHENE (TRICHLOROETHYLENE)
10.U	UG/KG	BENZENE
10.U	UG/KG	DIBROMOCHLOROMETHANE
10.U	UG/KG	1,1,2-TRICHLOROETHANE
10.U	UG/KG	CIS-1,3-DICHLOROPROPENE
10.U	UG/KG	BROMOFORM
10.U	UG/KG	BROMOBENZENE
10.U	UG/KG	1,1,2,2-TETRACHLOROETHANE
10.U	UG/KG	TETRACHLOROETHENE (TETRACHLOROETHYLENE)
10.U	UG/KG	1,3-DICHLOROPROPANE
25.U	UG/KG	METHYL BUTYL KETONE
10.U	UG/KG	TOLUENE
10.U	UG/KG	CHLOROBENZENE

RESULTS	UNITS	ANALYTE
10.U	UG/KG	1,1,1,2-TETRACHLOROETHANE
10.U	UG/KG	ETHYL BENZENE
10.U	UG/KG	(M- AND/OR P-)XYLENE
10.U	UG/KG	O-XYLENE
10.U	UG/KG	STYRENE
10.U	UG/KG	1,2,3-TRICHLOROPROPANE
10.U	UG/KG	O-CHLOROTOLUENE
10.U	UG/KG	P-CHLOROTOLUENE
10.U	UG/KG	1,3-DICHLOROBENZENE
10.U	UG/KG	1,4-DICHLOROBENZENE
10.U	UG/KG	1,2-DICHLOROBENZENE
10.U	UG/KG	1,2-DIBROMOETHANE (EDB)
10.U	UG/KG	ISOPROPYLBENZENE
10.U	UG/KG	N-PROPYLBENZENE
10.U	UG/KG	1,3,5-TRIMETHYLBENZENE
10.U	UG/KG	TERT-BUTYLBENZENE
10.U	UG/KG	1,2,4-TRIMETHYLBENZENE
10.U	UG/KG	SEC-BUTYLBENZENE
10.U	UG/KG	P-ISOPROPYLTOLUENE
10.U	UG/KG	N-BUTYLBENZENE
10.U	UG/KG	1,2-DIBROMO-3-CHLOROPROPANE
10.U	UG/KG	1,2,4-TRICHLOROBENZENE
10.U	UG/KG	HEXACHLORO-1,3-BUTADIENE
10.U	UG/KG	1,2,3-TRICHLOROBENZENE
10.0	%	% MOISTURE

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

Continued on page 2



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region 4

Science and Ecosystem Support Division
980 College Station Road
Athens, Georgia 30605-2720

MEMORANDUM

Date: 03/12/98

Subject: Results of EXTRACTABLES ORGANIC Chemistry Section Sample Analysis
98-0241 Tennessee Products
Chattanooga, TN

*Soils/
Sediments*

From: Dennis Revell

To: Alan Auwarter

CC: SESD/EAB/EES

Thru: William McDaniel *W. McDaniel*
Chief, ORGANIC Chemistry Section

Attached are the results of analysis of samples collected as part of the subject project. If you have any questions, please contact me.

ATTACHMENT

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
890U	UG/KG	3,3'-DICHLORO BENZIDINE
890U	UG/KG	DI-N-OCTYLPHTHALATE
950	UG/KG	BENZO(B)FLUORANTHENE
390	UG/KG	BENZO(K)FLUORANTHENE
830	UG/KG	BENZO-A-PYRENE
640J	UG/KG	INDENO (1,2,3-CD) PYRENE
160	UG/KG	DIBENZO(A,H)ANTHRACENE
480	UG/KG	BENZO(GHI)PERYLENE
890U	UG/KG	2-CHLOROPHENOL
890U	UG/KG	2-METHYLPHENOL
890U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
890U	UG/KG	2-NITROPHENOL
890U	UG/KG	PHENOL
890U	UG/KG	2,4-DIMETHYLPHENOL
890U	UG/KG	2,4-DICHLOROPHENOL
890U	UG/KG	2,4,6-TRICHLOROPHENOL
890U	UG/KG	2,4,5-TRICHLOROPHENOL
890U	UG/KG	4-CHLORO-3-METHYLPHENOL
1800U	UG/KG	2,4-DINITROPHENOL
1800U	UG/KG	2-METHYL-4,6-DINITROPHENOL
1800U	UG/KG	PENTACHLOROPHENOL
1800U	UG/KG	4-NITROPHENOL
890U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
210J	UG/KG	CARBAZOLE
33.2	%	% MOISTURE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

TRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SED, ATHENS, GA

Production Date: 03/10/98 14:49

Sample 2374 FY 1998 Project: 98-0241

MISCELLANEOUS COMPOUNDS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: REM1

Media: SEDIM

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
1000JN	UG/KG	BENZOFLUORANTHENE (NOT B OR K)

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit
R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Continued by 031098-1 When no value is reported, see comments column for explanation of the value of the result.

Sample 2375 FY 1998 Project: 98-0241

EXTRACTABLES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: REM2

Media: SEDIM

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
770U	UG/KG	BIS(2-CHLOROETHYL) ETHER
770U	UG/KG	HEXACHLOROETHANE
770U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
770U	UG/KG	N-NITROSODI-N-PROPYLAMINE
770U	UG/KG	NITROBENZENE
770U	UG/KG	HEXACHLOROBUTADIENE
1400	UG/KG	2-METHYLNAPHTHALENE
770U	UG/KG	1,2,4-TRICHLOROBENZENE
1600	UG/KG	NAPHTHALENE
770U	UG/KG	4-CHLOROANILINE
770U	UG/KG	BIS(2-CHLOROETHOXY)METHANE
770U	UG/KG	ISOPHORONE
770U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
770U	UG/KG	2-CHLORONAPHTHALENE
770U	UG/KG	2-NITROANILINE
340J	UG/KG	ACENAPHTHYLENE
3900	UG/KG	ACENAPHTHENE
770U	UG/KG	DIMETHYL PHTHALATE
2800	UG/KG	DIBENZOFURAN
770U	UG/KG	2,4-DINITROTOLUENE
770U	UG/KG	2,6-DINITROTOLUENE
770U	UG/KG	3-NITROANILINE
770U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
770U	UG/KG	4-NITROANILINE
4500	UG/KG	FLUORENE
770U	UG/KG	DIETHYL PHTHALATE
770U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
770U	UG/KG	HEXACHLOROBENZENE (HCB)
770U	UG/KG	4-BROMOPHENYL PHENYL ETHER
18000	UG/KG	PHENANTHRENE
3500	UG/KG	ANTHRACENE
770U	UG/KG	DI-N-BUTYLPHTHALATE
17000	UG/KG	FLUORANTHENE
9600	UG/KG	PYRENE
770U	UG/KG	BENZYL BUTYL PHTHALATE
770U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
4100	UG/KG	BENZO(A)ANTHRACENE
3300	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
770U	UG/KG	3,3'-DICHLOROBENZIDINE
770U	UG/KG	DI-N-OCTYLPHTHALATE
2600	UG/KG	BENZO(B)FLUORANTHENE
1000	UG/KG	BENZO(K)FLUORANTHENE
2300	UG/KG	BENZO-A-PYRENE
1800	UG/KG	INDENO (1,2,3-CD) PYRENE
430J	UG/KG	DIBENZO(A,H)ANTHRACENE
1400	UG/KG	BENZO(GH)PERYLENE
770U	UG/KG	2-CHLOROPHENOL
770U	UG/KG	2-METHYLPHENOL
770U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
770U	UG/KG	2-NITROPHENOL
770U	UG/KG	PHENOL
770U	UG/KG	2,4-DIMETHYLPHENOL
770U	UG/KG	2,4-DICHLOROPHENOL
770U	UG/KG	2,4,6-TRICHLOROPHENOL
770U	UG/KG	2,4,5-TRICHLOROPHENOL
770U	UG/KG	4-CHLORO-3-METHYLPHENOL
1500U	UG/KG	2,4-DINITROPHENOL
1500U	UG/KG	2-METHYL-4,6-DINITROPHENOL
1500U	UG/KG	PENTACHLOROPHENOL
1500U	UG/KG	4-NITROPHENOL
770U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
1500	UG/KG	CARBAZOLE
20.7	%	% MOISTURE

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Sample 2376 FY 1998 Project 98-0241

Produced by: Dennis Revell

EXTRACTABLES SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Field Station: ACTR

Ending:

Media: SEDIM

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
8900U	UG/KG	BIS(2-CHLOROETHYL) ETHER
8900U	UG/KG	HEXACHLOROETHANE
8900U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
8900U	UG/KG	N-NITROSODI-N-PROPYLAMINE
8900U	UG/KG	NITROBENZENE
8900U	UG/KG	HEXACHLOROBUTADIENE
1200J	UG/KG	2-METHYLNAPHTHALENE
8900U	UG/KG	1,2,4-TRICHLOROBENZENE
2700J	UG/KG	NAPHTHALENE
8900U	UG/KG	4-CHLOROANILINE
8900U	UG/KG	BIS(2-CHLOROETHOXY)METHANE
8900U	UG/KG	ISOPHORONE
8900U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
8900U	UG/KG	2-CHLORONAPHTHALENE
8900U	UG/KG	2-NITROANILINE
1900J	UG/KG	ACENAPHTHYLENE
3300J	UG/KG	ACENAPHTHENE
8900U	UG/KG	DIMETHYL PHTHALATE
2700J	UG/KG	DIBENZOFURAN
8900U	UG/KG	2,4-DINITROTOLUENE
8900U	UG/KG	2,6-DINITROTOLUENE
8900U	UG/KG	3-NITROANILINE
8900U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
8900U	UG/KG	4-NITROANILINE
5500J	UG/KG	FLUORENE
8900U	UG/KG	DIETHYL PHTHALATE
8900U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
8900U	UG/KG	HEXACHLOROBENZENE (HCB)
8900U	UG/KG	4-BROMOPHENYL PHENYL ETHER
1000	UG/KG	PHENANTHRENE
8800J	UG/KG	ANTHRACENE
8900U	UG/KG	DI-N-BUTYLPHTHALATE
3000	UG/KG	FLUORANTHENE
7000	UG/KG	PYRENE
8900U	UG/KG	BENZYL BUTYL PHTHALATE
8900U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
1000	UG/KG	BENZO(A)ANTHRACENE
9000	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
8900U	UG/KG	3,3'-DICHLOROBENZIDINE
8900U	UG/KG	DI-N-OCTYLPHTHALATE
19000	UG/KG	BENZO(B)FLUORANTHENE
6900	UG/KG	BENZO(K)FLUORANTHENE
16000	UG/KG	BENZO-A-PYRENE
14000	UG/KG	INDENO (1,2,3-CD) PYRENE
3000	UG/KG	DIBENZO(A,H)ANTHRACENE
10000	UG/KG	BENZO(GHI)PERYLENE
8900U	UG/KG	2-CHLOROPHENOL
8900U	UG/KG	2-METHYLPHENOL
8900U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
8900U	UG/KG	2-NITROPHENOL
8900U	UG/KG	PHENOL
8900U	UG/KG	2,4-DIMETHYLPHENOL
8900U	UG/KG	2,4-DICHLOROPHENOL
8900U	UG/KG	2,4,6-TRICHLOROPHENOL
8900U	UG/KG	2,4,5-TRICHLOROPHENOL
8900U	UG/KG	4-CHLORO-3-METHYLPHENOL
18000U	UG/KG	2,4-DINITROPHENOL
18000U	UG/KG	2-METHYL-4,6-DINITROPHENOL
18000U	UG/KG	PENTACHLOROPHENOL
18000U	UG/KG	4-NITROPHENOL
8900U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
920J	UG/KG	CARBAZOLE
29.5	%	% MOISTURE

NA - not analyzed, NAI - interferences, J - estimated value, N - presumptive evidence of presence of material

U - material was analyzed for but not detected - the number is the minimum quantitation limit.

NAI - indicates that data unusable - compound may or may not be present - resampling and reanalysis is necessary for verification

Sample 2376 FY 1998 Project: 98-0241

Produced by: Dennis Revell

MISCELLANEOUS COMPOUNDS

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station: ACTR

Ending:

Media: SEDIM

Information on detection limits shortly

RESULTS UNITS ANALYTE

40000JN UG/KG BENZOFLUORANTHENE (NOT B OR K) (2 ISOMERS)

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

id indicates that data unusable compound may or may not be present. resampling and reanalysis is necessary for verification.

Sample 2377 FY 1998 Project: 98-0241

Produced by: Dennis Revell

EXTRACTABLES SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station: REFERENCE SOIL

Ending:

Media: SOIL

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
820U	UG/KG	BIS(2-CHLOROETHYL) ETHER
820U	UG/KG	HEXACHLOROETHANE
820U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
820U	UG/KG	N-NITROSODI-N-PROPYLAMINE
820U	UG/KG	NITROBENZENE
820U	UG/KG	HEXACHLOROBUTADIENE
820U	UG/KG	2-METHYLNAPHTHALENE
820U	UG/KG	1,2,4-TRICHLOROBENZENE
820U	UG/KG	NAPHTHALENE
820U	UG/KG	4-CHLOROANILINE
820U	UG/KG	BIS(2-CHLOROETHOXY)METHANE
820U	UG/KG	ISOPHORONE
820U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
820U	UG/KG	2-CHLORONAPHTHALENE
820U	UG/KG	2-NITROANILINE
820U	UG/KG	ACENAPHTHYLENE
820U	UG/KG	ACENAPHTHENE
820U	UG/KG	DIMETHYL PHTHALATE
820U	UG/KG	DIBENZOFURAN
820U	UG/KG	2,4-DINITROTOLUENE
820U	UG/KG	2,6-DINITROTOLUENE
820U	UG/KG	3-NITROANILINE
820U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
820U	UG/KG	4-NITROANILINE
820U	UG/KG	FLUORENE
820U	UG/KG	DIETHYL PHTHALATE
820U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
820U	UG/KG	HEXACHLOROBENZENE (HCB)
820U	UG/KG	4-BROMOPHENYL PHENYL ETHER
150J	UG/KG	PHENANTHRENE
820U	UG/KG	ANTHRACENE
820U	UG/KG	DI-N-BUTYLPHTHALATE
370J	UG/KG	FLUORANTHENE
230J	UG/KG	PYRENE
820U	UG/KG	BENZYL BUTYL PHTHALATE
820U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
140J	UG/KG	BENZO(A)ANTHRACENE
220J	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
820U	UG/KG	3,3'-DICHLOROBENZIDINE
820U	UG/KG	DI-N-OCTYLPHTHALATE
190J	UG/KG	BENZO(B)FLUORANTHENE
91J	UG/KG	BENZO(K)FLUORANTHENE
130J	UG/KG	BENZO-A-PYRENE
140J	UG/KG	INDENO (1,2,3-CD) PYRENE
820U	UG/KG	DIBENZO(A,H)ANTHRACENE
110J	UG/KG	BENZO(GHI)PERYLENE
820U	UG/KG	2-CHLOROPHENOL
820U	UG/KG	2-METHYLPHENOL
820U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
820U	UG/KG	2-NITROPHENOL
820U	UG/KG	PHENOL
820U	UG/KG	2,4-DIMETHYLPHENOL
820U	UG/KG	2,4-DICHLOROPHENOL
820U	UG/KG	2,4,6-TRICHLOROPHENOL
820U	UG/KG	2,4,5-TRICHLOROPHENOL
820U	UG/KG	4-CHLORO-3-METHYLPHENOL
1600U	UG/KG	2,4-DINITROPHENOL
1600U	UG/KG	2-METHYL-4,6-DINITROPHENOL
1600U	UG/KG	PENTACHLOROPHENOL
1600U	UG/KG	4-NITROPHENOL
820U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
820U	UG/KG	CARBAZOLE
22.6	%	% MOISTURE

Average value. NA-not analyzed. NAI-Interferences. J-estimated value. N-presumptive evidence of presence of material.

L-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not Detected. the number is the minimum quantitation limit

jc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

TABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/10/98 14:49

Sample 2377 FY 1998 Project: 98-0241

MISCELLANEOUS COMPOUNDS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Station: REFERENCE SOIL

Media: SOIL

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
N	UG/KG	PETROLEUM PRODUCT

ge value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

l value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit
 indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

THIS DOCUMENT IS UNCLASSIFIED FOR RELEASE TO THE PUBLIC DATE 03-10-98 BY 1043

Sample 2378 FY 1998 Project 98-0241

Produced by: Dennis Revell

EXTRACTABLES SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Lab/Station: S1

Ending:

Media: SOIL

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
910U	UG/KG	BIS(2-CHLOROETHYL) ETHER
910U	UG/KG	HEXACHLOROETHANE
910U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
910U	UG/KG	N-NITROSODI-N-PROPYLAMINE
910U	UG/KG	NITROBENZENE
910U	UG/KG	HEXACHLOROBUTADIENE
910U	UG/KG	2-METHYLNAPHTHALENE
910U	UG/KG	1,2,4-TRICHLOROBENZENE
910U	UG/KG	NAPHTHALENE
910U	UG/KG	4-CHLOROANILINE
910U	UG/KG	BIS(2-CHLOROETHOXY)METHANE
910U	UG/KG	ISOPHORONE
910U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
910U	UG/KG	2-CHLORONAPHTHALENE
910U	UG/KG	2-NITROANILINE
120J	UG/KG	ACENAPHTHYLENE
910U	UG/KG	ACENAPHTHENE
910U	UG/KG	DIMETHYL PHTHALATE
910U	UG/KG	DIBENZOFURAN
910U	UG/KG	2,4-DINITROTOLUENE
910U	UG/KG	2,6-DINITROTOLUENE
910U	UG/KG	3-NITROANILINE
910U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
910U	UG/KG	4-NITROANILINE
910U	UG/KG	FLUORENE
910U	UG/KG	DIETHYL PHTHALATE
910U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
910U	UG/KG	HEXACHLOROBENZENE (HCB)
910U	UG/KG	4-BROMOPHENYL PHENYL ETHER
370J	UG/KG	PHENANTHRENE
92J	UG/KG	ANTHRACENE
910U	UG/KG	DI-N-BUTYLPHTHALATE
1400	UG/KG	FLUORANTHENE
990	UG/KG	PYRENE
910U	UG/KG	BENZYL BUTYL PHTHALATE
910U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
840J	UG/KG	BENZO(A)ANTHRACENE
920	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
910U	UG/KG	3,3'-DICHLOROBENZIDINE
910U	UG/KG	DI-N-OCTYLPHTHALATE
1100	UG/KG	BENZO(B)FLUORANTHENE
300J	UG/KG	BENZO(K)FLUORANTHENE
730J	UG/KG	BENZO-A-PYRENE
860J	UG/KG	INDENO (1,2,3-CD) PYRENE
200J	UG/KG	DIBENZO(A,H)ANTHRACENE
670J	UG/KG	BENZO(GHI)PERYLENE
910U	UG/KG	2-CHLOROPHENOL
910U	UG/KG	2-METHYLPHENOL
910U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
910U	UG/KG	2-NITROPHENOL
910U	UG/KG	PHENOL
910U	UG/KG	2,4-DIMETHYLPHENOL
910U	UG/KG	2,4-DICHLOROPHENOL
910U	UG/KG	2,4,6-TRICHLOROPHENOL
910U	UG/KG	2,4,5-TRICHLOROPHENOL
910U	UG/KG	4-CHLORO-3-METHYLPHENOL
1800U	UG/KG	2,4-DINITROPHENOL
1800U	UG/KG	2-METHYL-4,6-DINITROPHENOL
1800U	UG/KG	PENTACHLOROPHENOL
1800U	UG/KG	4-NITROPHENOL
910U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
910U	UG/KG	CARBAZOLE
33.4	%	% MOISTURE

age value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

al value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

Sample 2378 FY 1998 Project: 98-0241

ISCELLANEOUS COMPOUNDS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Station: S1

Media: SOIL

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
000JN	UG/KG	BENZOFLUORANTHENE (NOT B OR K)

The value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

FACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/10/98 14:49

Sample 2379 FY 1998 Project: 98-0241

Produced by: Dennis Revell

EXTRACTABLES SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station: S2

Ending:

Media: SOIL

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
870U	UG/KG	BIS(2-CHLOROETHYL) ETHER
870U	UG/KG	HEXACHLOROETHANE
870U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
870U	UG/KG	N-NITROSODI-N-PROPYLAMINE
870U	UG/KG	NITROBENZENE
870U	UG/KG	HEXACHLOROBUTADIENE
870U	UG/KG	2-METHYLNAPHTHALENE
870U	UG/KG	1,2,4-TRICHLOROBENZENE
870U	UG/KG	NAPHTHALENE
870U	UG/KG	4-CHLOROANILINE
870U	UG/KG	BIS(2-CHLOROETHOXY)METHANE
870U	UG/KG	ISOPHORONE
870U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
870U	UG/KG	2-CHLORONAPHTHALENE
870U	UG/KG	2-NITROANILINE
510J	UG/KG	ACENAPHTHYLENE
870U	UG/KG	ACENAPHTHENE
870U	UG/KG	DIMETHYL PHTHALATE
870U	UG/KG	DIBENZOFURAN
870U	UG/KG	2,4-DINITROTOLUENE
870U	UG/KG	2,6-DINITROTOLUENE
870U	UG/KG	3-NITROANILINE
870U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
870U	UG/KG	4-NITROANILINE
870U	UG/KG	FLUORENE
870U	UG/KG	DIETHYL PHTHALATE
870U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
870U	UG/KG	HEXACHLOROBENZENE (HCB)
870U	UG/KG	4-BROMOPHENYL PHENYL ETHER
1100	UG/KG	PHENANTHRENE
520J	UG/KG	ANTHRACENE
870U	UG/KG	DI-N-BUTYLPHTHALATE
5000	UG/KG	FLUORANTHENE
2900	UG/KG	PYRENE
870U	UG/KG	BENZYL BUTYL PHTHALATE
870U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
2600	UG/KG	BENZO(A)ANTHRACENE
3000	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
870U	UG/KG	3,3'-DICHLORO BENZIDINE
870U	UG/KG	DI-N-OCTYLPHTHALATE
3100	UG/KG	BENZO(B)FLUORANTHENE
1500	UG/KG	BENZO(K)FLUORANTHENE
2500	UG/KG	BENZO-A-PYRENE
1700	UG/KG	INDENO (1,2,3-CD) PYRENE
680J	UG/KG	DIBENZO(A,H)ANTHRACENE
1500	UG/KG	BENZO(GHI)PERYLENE
870U	UG/KG	2-CHLOROPHENOL
870U	UG/KG	2-METHYLPHENOL
870U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
870U	UG/KG	2-NITROPHENOL
870U	UG/KG	PHENOL
870U	UG/KG	2,4-DIMETHYLPHENOL
870U	UG/KG	2,4-DICHLOROPHENOL
870U	UG/KG	2,4,6-TRICHLOROPHENOL
870U	UG/KG	2,4,5-TRICHLOROPHENOL
870U	UG/KG	4-CHLORO-3-METHYLPHENOL
1700U	UG/KG	2,4-DINITROPHENOL
1700U	UG/KG	2-METHYL-4,6-DINITROPHENOL
1700U	UG/KG	PENTACHLOROPHENOL
1700U	UG/KG	4-NITROPHENOL
870U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
1000	UG/KG	CARBAZOLE
29.3	%	% MOISTURE

average value. NA-not analyzed. NAI-Interferences. J-estimated value. N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit

jc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

continued in 1915. I wish to mention an interesting possibility: "conspicuous" is listed in the Oxford English Dictionary as a verb, meaning "to be conspicuous." I wonder if this is the same word as the noun "conspicuousness," which is also listed in the OED.

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/10/98 14:49

Sample 2379 FY 1998 Project: 98-0241

MISCELLANEOUS COMPOUNDS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S2

Media: SOIL

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
---------	-------	---------

5000JN UG/KG BENZOFLUORANTHENE (NOT B OR K) (2 ISOMERS)

CON	CG/KG	BENEFIT ESTIMANT/HEM
N	UG/KG	PETROLEUM PRODUCT

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit
 qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

Sample 2380 FY 1998 Project: 98-0241

EXTRACTABLES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S3

Media: SOIL

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
1200U	UG/KG	BIS(2-CHLOROETHYL) ETHER
1200U	UG/KG	HEXACHLOROETHANE
1200U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
1200U	UG/KG	N-NITROSODI-N-PROPYLAMINE
1200U	UG/KG	NITROBENZENE
1200U	UG/KG	HEXACHLOROBUTADIENE
1200U	UG/KG	2-METHYLNAPHTHALENE
1200U	UG/KG	1,2,4-TRICHLOROBENZENE
1200U	UG/KG	NAPHTHALENE
1200U	UG/KG	4-CHLOROANILINE
1200U	UG/KG	BIS(2-CHLOROETHOXY)METHANE
1200U	UG/KG	ISOPHORONE
1200U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
1200U	UG/KG	2-CHLORONAPHTHALENE
1200U	UG/KG	2-NITROANILINE
210J	UG/KG	ACENAPHTHYLENE
1200U	UG/KG	ACENAPHTHENE
1200U	UG/KG	DIMETHYL PHTHALATE
1200U	UG/KG	DIBENZOFURAN
1200U	UG/KG	2,4-DINITROTOLUENE
1200U	UG/KG	2,6-DINITROTOLUENE
1200U	UG/KG	3-NITROANILINE
1200U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
1200U	UG/KG	4-NITROANILINE
1200U	UG/KG	FLUORENE
1200U	UG/KG	DIETHYL PHTHALATE
1200U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
1200U	UG/KG	HEXACHLOROBENZENE (HCB)
1200U	UG/KG	4-BROMOPHENYL PHENYL ETHER
790J	UG/KG	PHENANTHRENE
220J	UG/KG	ANTHRACENE
1200U	UG/KG	DI-N-BUTYLPHTHALATE
3800	UG/KG	FLUORANTHENE
2100	UG/KG	PYRENE
1200U	UG/KG	BENZYL BUTYL PHTHALATE
1200U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
1900	UG/KG	BENZO(A)ANTHRACENE
2000	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
1200U	UG/KG	3,3'-DICHLOROBENZIDINE
1200U	UG/KG	DI-N-OCTYLPHTHALATE
2000	UG/KG	BENZO(B)FLUORANTHENE
700J	UG/KG	BENZO(K)FLUORANTHENE
1400	UG/KG	BENZO-A-PYRENE
1300	UG/KG	INDENO (1,2,3-CD) PYRENE
310J	UG/KG	DIBENZO(A,H)ANTHRACENE
920J	UG/KG	BENZO(GHI)PERYLENE
1200U	UG/KG	2-CHLOROPHENOL
1200U	UG/KG	2-METHYLPHENOL
1200U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
1200U	UG/KG	2-NITROPHENOL
1200U	UG/KG	PHENOL
1200U	UG/KG	2,4-DIMETHYLPHENOL
1200U	UG/KG	2,4-DICHLOROPHENOL
1200U	UG/KG	2,4,6-TRICHLOROPHENOL
1200U	UG/KG	2,4,5-TRICHLOROPHENOL
1200U	UG/KG	4-CHLORO-3-METHYLPHENOL
1200U	UG/KG	2,4-DINITROPHENOL
1200U	UG/KG	2-METHYL-4,6-DINITROPHENOL
1200U	UG/KG	PENTACHLOROPHENOL
1200U	UG/KG	4-NITROPHENOL
1200U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
1200U	UG/KG	CARBAZOLE
43.1	%	% MOISTURE

range value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

ual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit. indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

Sample 2380 FY 1998 Project: 98-0241

MISCELLANEOUS COMPOUNDS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S3

Media: SOIL

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS UNITS ANALYTE

2000JN UG/KG BENZOFLUORANTHENE (NOT B OR K)

average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit
pc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Produced by: 03/10/98 14:49

Sample 2381 FY 1998 Project: 98-0241

EXTRACTABLES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S4

Media: SOIL

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
1000U	UG/KG	BIS(2-CHLOROETHYL) ETHER
1000U	UG/KG	HEXACHLOROETHANE
1000U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
1000U	UG/KG	N-NITROSODI-N-PROPYLAMINE
1000U	UG/KG	NITROBENZENE
1000U	UG/KG	HEXACHLOROBUTADIENE
1000U	UG/KG	2-METHYLNAPHTHALENE
1000U	UG/KG	1,2,4-TRICHLOROBENZENE
1000U	UG/KG	NAPHTHALENE
1000U	UG/KG	4-CHLOROANILINE
1000U	UG/KG	BIS(2-CHLOROETHOXY)METHANE
1000U	UG/KG	ISOPHORONE
1000U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
1000U	UG/KG	2-CHLORONAPHTHALENE
1000U	UG/KG	2-NITROANILINE
1000U	UG/KG	ACENAPHTHYLENE
1000U	UG/KG	ACENAPHTHENE
1000U	UG/KG	DIMETHYL PHTHALATE
1000U	UG/KG	DIBENZOFURAN
1000U	UG/KG	2,4-DINITROTOLUENE
1000U	UG/KG	2,6-DINITROTOLUENE
1000U	UG/KG	3-NITROANILINE
1000U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
1000U	UG/KG	4-NITROANILINE
1000U	UG/KG	FLUORENE
1000U	UG/KG	DIETHYL PHTHALATE
1000U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
1000U	UG/KG	HEXACHLOROBENZENE (HCB)
1000U	UG/KG	4-BROMOPHENYL PHENYL ETHER
290J	UG/KG	PHENANTHRENE
1000U	UG/KG	ANTHRACENE
1000U	UG/KG	DI-N-BUTYLPHTHALATE
960J	UG/KG	FLUORANTHENE
670J	UG/KG	PYRENE
1000U	UG/KG	BENZYL BUTYL PHTHALATE
1000U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
520J	UG/KG	BENZO(A)ANTHRACENE
600J	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
1000U	UG/KG	3,3'-DICHLOROBENZIDINE
1000U	UG/KG	DI-N-OCTYLPHTHALATE
600J	UG/KG	BENZO(B)FLUORANTHENE
400J	UG/KG	BENZO(K)FLUORANTHENE
480J	UG/KG	BENZO-A-PYRENE
460J	UG/KG	INDENO (1,2,3-CD) PYRENE
110J	UG/KG	DIBENZO(A,H)ANTHRACENE
340J	UG/KG	BENZO(GH)PERYLENE
1000U	UG/KG	2-CHLOROPHENOL
1000U	UG/KG	2-METHYLPHENOL
1000U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
1000U	UG/KG	2-NITROPHENOL
1000U	UG/KG	PHENOL
1000U	UG/KG	2,4-DIMETHYLPHENOL
1000U	UG/KG	2,4-DICHLOROPHENOL
1000U	UG/KG	2,4,6-TRICHLOROPHENOL
1000U	UG/KG	2,4,5-TRICHLOROPHENOL
1000U	UG/KG	4-CHLORO-3-METHYLPHENOL
2000U	UG/KG	2,4-DINITROPHENOL
2000U	UG/KG	2-METHYL-4,6-DINITROPHENOL
2000U	UG/KG	PENTACHLOROPHENOL
2000U	UG/KG	4-NITROPHENOL
1000U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
1000U	UG/KG	CARBAZOLE
38.7	%	% MOISTURE

NA-average value, NA-not analyzed, NAI-Interferences, J-estimated value, N-presumptive evidence of presence of material.

* actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit.

qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

[illegible]

Sample 2382 FY 1998 Project: 98-0241

EXTRACTABLES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S5

Media: SOIL

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
950U	UG/KG	BIS(2-CHLOROETHYL) ETHER
950U	UG/KG	HEXACHLOROETHANE
950U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
950U	UG/KG	N-NITROSODI-N-PROPYLAMINE
950U	UG/KG	NITROBENZENE
950U	UG/KG	HEXACHLOROBUTADIENE
950U	UG/KG	2-METHYLNAPHTHALENE
950U	UG/KG	1,2,4-TRICHLOROBENZENE
950U	UG/KG	NAPHTHALENE
950U	UG/KG	4-CHLOROANILINE
950U	UG/KG	BIS(2-CHLOROETHOXY)METHANE
950U	UG/KG	ISOPHORONE
950U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
950U	UG/KG	2-CHLORONAPHTHALENE
950U	UG/KG	2-NITROANILINE
120J	UG/KG	ACENAPHTHYLENE
950U	UG/KG	ACENAPHTHENE
950U	UG/KG	DIMETHYL PHTHALATE
950U	UG/KG	DIBENZOFURAN
950U	UG/KG	2,4-DINITROTOLUENE
950U	UG/KG	2,6-DINITROTOLUENE
950U	UG/KG	3-NITROANILINE
950U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
950U	UG/KG	4-NITROANILINE
950U	UG/KG	FLUORENE
950U	UG/KG	DIETHYL PHTHALATE
950U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
950U	UG/KG	HEXACHLOROBENZENE (HCB)
950U	UG/KG	4-BROMOPHENYL PHENYL ETHER
270J	UG/KG	PHENANTHRENE
950U	UG/KG	ANTHRACENE
950U	UG/KG	DI-N-BUTYLPHTHALATE
1200	UG/KG	FLUORANTHENE
820J	UG/KG	PYRENE
950U	UG/KG	BENZYL BUTYL PHTHALATE
950U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
800J	UG/KG	BENZO(A)ANTHRACENE
790J	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
950U	UG/KG	3,3'-DICHLOROBENZIDINE
950U	UG/KG	DI-N-OCTYLPHTHALATE
1000	UG/KG	BENZO(B)FLUORANTHENE
390J	UG/KG	BENZO(K)FLUORANTHENE
680J	UG/KG	BENZO-A-PYRENE
670J	UG/KG	INDENO (1,2,3-CD) PYRENE
150J	UG/KG	DIBENZO(A,H)ANTHRACENE
490J	UG/KG	BENZO(GH)PERYLENE
950U	UG/KG	2-CHLOROPHENOL
950U	UG/KG	2-METHYLPHENOL
950U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
950U	UG/KG	2-NITROPHENOL
950U	UG/KG	PHENOL
950U	UG/KG	2,4-DIMETHYLPHENOL
950U	UG/KG	2,4-DICHLOROPHENOL
950U	UG/KG	2,4,6-TRICHLOROPHENOL
950U	UG/KG	2,4,5-TRICHLOROPHENOL
950U	UG/KG	4-CHLORO-3-METHYLPHENOL
1900U	UG/KG	2,4-DINITROPHENOL
1900U	UG/KG	2-METHYL-4,6-DINITROPHENOL
1900U	UG/KG	PENTACHLOROPHENOL
1900U	UG/KG	4-NITROPHENOL
950U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
950U	UG/KG	CARBAZOLE
34.0	%	% MOISTURE

Average value. NA-not analyzed. NAI-Interferences. J-estimated value. N-presumptive evidence of presence of material.

Actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

Sample 2382 FY 1998 Project: 98-0241

MISCELLANEOUS COMPOUNDS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S5

Media: SOIL

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
1000JN	UG/KG	BENZOFLUORANTHENE (NOT B OR K)

Average value. NA-not analyzed. NAI-Interferences. J-estimated value. N-presumptive evidence of presence of material.

Actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

pc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/12/98 15:27

Sample 2383 FY 1998 Project 98-0241

EXTRACTABLES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: STA

Media: SOIL

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
740U	UG/KG	BIS(2-CHLOROETHYL) ETHER
740U	UG/KG	HEXACHLOROETHANE
740U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
740U	UG/KG	N-NITROSODI-N-PROPYLAMINE
740U	UG/KG	NITROBENZENE
740U	UG/KG	HEXACHLOROBUTADIENE
740U	UG/KG	2-METHYLNAPHTHALENE
740U	UG/KG	1,2,4-TRICHLOROBENZENE
740U	UG/KG	NAPHTHALENE
740U	UG/KG	4-CHLOROANILINE
740U	UG/KG	BIS(2-CHLOROETHOXY)METHANE
740U	UG/KG	ISOPHORONE
740U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
740U	UG/KG	2-CHLORONAPHTHALENE
740U	UG/KG	2-NITROANILINE
340J	UG/KG	ACENAPHTHYLENE
740U	UG/KG	ACENAPHTHENE
740U	UG/KG	DIMETHYL PHTHALATE
740U	UG/KG	DIBENZOFURAN
740U	UG/KG	2,4-DINITROTOLUENE
740U	UG/KG	2,6-DINITROTOLUENE
740U	UG/KG	3-NITROANILINE
740U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
740U	UG/KG	4-NITROANILINE
740U	UG/KG	FLUORENE
740U	UG/KG	DIETHYL PHTHALATE
740U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
740U	UG/KG	HEXACHLOROBENZENE (HCB)
740U	UG/KG	4-BROMOPHENYL PHENYL ETHER
390J	UG/KG	PHENANTHRENE
300J	UG/KG	ANTHRACENE
740U	UG/KG	DI-N-BUTYLPHTHALATE
3200	UG/KG	FLUORANTHENE
1900	UG/KG	PYRENE
740U	UG/KG	BENZYL BUTYL PHTHALATE
740U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
2100	UG/KG	BENZO(A)ANTHRACENE
2100	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
740U	UG/KG	3,3'-DICHLOROBENZIDINE
740U	UG/KG	DI-N-OCTYLPHTHALATE
2300	UG/KG	BENZO(B)FLUORANTHENE
930	UG/KG	BENZO(K)FLUORANTHENE
1800	UG/KG	BENZO-A-PYRENE
1600	UG/KG	INDENO (1,2,3-CD) PYRENE
380J	UG/KG	DIBENZO(A,H)ANTHRACENE
1200	UG/KG	BENZO(GH)PERYLENE
740U	UG/KG	2-CHLOROPHENOL
740U	UG/KG	2-METHYLPHENOL
740U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
740U	UG/KG	2-NITROPHENOL
740U	UG/KG	PHENOL
740U	UG/KG	2,4-DIMETHYLPHENOL
740U	UG/KG	2,4-DICHLOROPHENOL
740U	UG/KG	2,4,6-TRICHLOROPHENOL
740U	UG/KG	2,4,5-TRICHLOROPHENOL
740U	UG/KG	4-CHLORO-3-METHYLPHENOL
1500U	UG/KG	2,4-DINITROPHENOL
1500U	UG/KG	2-METHYL-4,6-DINITROPHENOL
1500U	UG/KG	PENTACHLOROPHENOL
1500U	UG/KG	4-NITROPHENOL
740U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
740U	UG/KG	CARBAZOLE
21.5	%	% MOISTURE

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit
B-go indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Sample 2383 FY 1998 Project: 98-0241
MISCELLANEOUS COMPOUNDS
Facility: Tennessee Products Chattanooga, TN
Program: SSF
Id/Station: STA
Media: SOIL

Produced by: Dennis Revell
Requestor:
Project Leader: AAUWARTE
Beginning: 02/13/98
Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
6000JN	UG/KG	BENZOFLUORANTHENE (NOT B OR K) (3 ISOMERS)

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit
as indicated that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/12/98 15:27

Sample 2384 FY 1998 Project 98-0241

EXTRACTABLES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: REFERENCE

Media: SEDIM

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
890U	UG/KG	BIS(2-CHLOROETHYL) ETHER
890U	UG/KG	HEXACHLOROETHANE
890U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
890U	UG/KG	N-NITROSODI-N-PROPYLAMINE
890U	UG/KG	NITROBENZENE
890U	UG/KG	HEXACHLOROBUTADIENE
890U	UG/KG	2-METHYLNAPHTHALENE
890U	UG/KG	1,2,4-TRICHLOROBENZENE
890U	UG/KG	NAPHTHALENE
890U	UG/KG	4-CHLOROANILINE
890U	UG/KG	BIS(2-CHLOROETHOXY)METHANE
890U	UG/KG	ISOPHORONE
890U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
890U	UG/KG	2-CHLORONAPHTHALENE
890U	UG/KG	2-NITROANILINE
890U	UG/KG	ACENAPHTHYLENE
890U	UG/KG	ACENAPHTHENE
890U	UG/KG	DIMETHYL PHTHALATE
890U	UG/KG	DIBENZOFURAN
890U	UG/KG	2,4-DINITROTOLUENE
890U	UG/KG	2,6-DINITROTOLUENE
890U	UG/KG	3-NITROANILINE
890U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
890U	UG/KG	4-NITROANILINE
890U	UG/KG	FLUORENE
890U	UG/KG	DIETHYL PHTHALATE
890U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
890U	UG/KG	HEXACHLOROBENZENE (HCB)
890U	UG/KG	4-BROMOPHENYL PHENYL ETHER
520J	UG/KG	PHENANTHRENE
890U	UG/KG	ANTHRACENE
890U	UG/KG	DI-N-BUTYLPHTHALATE
1600	UG/KG	FLUORANTHENE
1000	UG/KG	PYRENE
890U	UG/KG	BENZYL BUTYL PHTHALATE
890U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
690J	UG/KG	BENZO(A)ANTHRACENE
850J	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
890U	UG/KG	3,3'-DICHLOROBENZIDINE
890U	UG/KG	DI-N-OCTYLPHTHALATE
620J	UG/KG	BENZO(B)FLUORANTHENE
530J	UG/KG	BENZO(K)FLUORANTHENE
610J	UG/KG	BENZO-A-PYRENE
370J	UG/KG	INDENO (1,2,3-CD) PYRENE
100J	UG/KG	DIBENZO(A,H)ANTHRACENE
350J	UG/KG	BENZO(GHI)PERYLENE
890U	UG/KG	2-CHLOROPHENOL
890U	UG/KG	2-METHYLPHENOL
890U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
890U	UG/KG	2-NITROPHENOL
890U	UG/KG	PHENOL
890U	UG/KG	2,4-DIMETHYLPHENOL
890U	UG/KG	2,4-DICHLOROPHENOL
890U	UG/KG	2,4,6-TRICHLOROPHENOL
890U	UG/KG	2,4,5-TRICHLOROPHENOL
890U	UG/KG	4-CHLORO-3-METHYLPHENOL
1800U	UG/KG	2,4-DINITROPHENOL
1800U	UG/KG	2-METHYL-4,6-DINITROPHENOL
1800U	UG/KG	PENTACHLOROPHENOL
1800U	UG/KG	4-NITROPHENOL
890U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
530J	UG/KG	CARBAZOLE
29.0	%	% MOISTURE

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

B-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

Sample 2384 FY 1998 Project: 98-0241
MISCELLANEOUS COMPOUNDS
Facility: Tennessee Products Chattanooga, TN
Program: SSF
Id/Station: REFERENCE
Media: SEDIM

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
N	UG/KG	PETROLEUM PRODUCT

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

TRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/12/98 15:27

Sample 2385 FY 1998 Project: 98-0241

EXTRACTABLES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: 6%

Media: SEDIM

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
900U	UG/KG	BIS(2-CHLOROETHYL) ETHER
900U	UG/KG	HEXACHLOROETHANE
900U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
900U	UG/KG	N-NITROSODI-N-PROPYLAMINE
900U	UG/KG	NITROBENZENE
900U	UG/KG	HEXACHLOROBUTADIENE
150J	UG/KG	2-METHYLNAPHTHALENE
900U	UG/KG	1,2,4-TRICHLOROENZENE
140J	UG/KG	NAPHTHALENE
900U	UG/KG	4-CHLOROANILINE
900U	UG/KG	BIS(2-CHLOROETHOXY)METHANE
900U	UG/KG	ISOPHORONE
900U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
900U	UG/KG	2-CHLORONAPHTHALENE
900U	UG/KG	2-NITROANILINE
130J	UG/KG	ACENAPHTHYLENE
420J	UG/KG	ACENAPHTHENE
900U	UG/KG	DIMETHYL PHTHALATE
280J	UG/KG	DIBENZOFURAN
900U	UG/KG	2,4-DINITROTOLUENE
900U	UG/KG	2,6-DINITROTOLUENE
900U	UG/KG	3-NITROANILINE
900U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
900U	UG/KG	4-NITROANILINE
570J	UG/KG	FLUORENE
900U	UG/KG	DIETHYL PHTHALATE
900U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
900U	UG/KG	HEXACHLOROBENZENE (HCB)
900U	UG/KG	4-BROMOPHENYL PHENYL ETHER
3800	UG/KG	PHENANTHRENE
740J	UG/KG	ANTHRACENE
900U	UG/KG	DI-N-BUTYLPHTHALATE
6600	UG/KG	FLUORANTHENE
2500	UG/KG	PYRENE
900U	UG/KG	BENZYL BUTYL PHTHALATE
900U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
2400	UG/KG	BENZO(A)ANTHRACENE
1900	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
900U	UG/KG	3,3'-DICHLOROBENZIDINE
900U	UG/KG	DI-N-OCTYLPHTHALATE
3100	UG/KG	BENZO(B)FLUORANTHENE
1100	UG/KG	BENZO(K)FLUORANTHENE
2400	UG/KG	BENZO-A-PYRENE
1700	UG/KG	INDENO (1,2,3-CD) PYRENE
1100	UG/KG	DIBENZO(A,H)ANTHRACENE
1300	UG/KG	BENZO(GH)PERYLENE
900U	UG/KG	2-CHLOROPHENOL
900U	UG/KG	2-METHYLPHENOL
900U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
900U	UG/KG	2-NITROPHENOL
900U	UG/KG	PHENOL
900U	UG/KG	2,4-DIMETHYLPHENOL
900U	UG/KG	2,4-DICHLOROPHENOL
900U	UG/KG	2,4,6-TRICHLOROPHENOL
900U	UG/KG	2,4,5-TRICHLOROPHENOL
900U	UG/KG	4-CHLORO-3-METHYLPHENOL
1800U	UG/KG	2,4-DINITROPHENOL
1800U	UG/KG	2-METHYL-4,6-DINITROPHENOL
1800U	UG/KG	PENTACHLOROPHENOL
1800U	UG/KG	4-NITROPHENOL
900U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
410J	UG/KG	CARBAZOLE
29.2	%	% MOISTURE

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material
actual value is known to be less than estimated value.

actual value is known to be less than value given L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit
uc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

[illegible]

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/19/98 13:36

Sample 2386 FY 1998 Project: 98-0241

Produced by: Dennis Revell

EXTRACTABLES SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station: 12%

Ending:

Media: SEDIM

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
850U	UG/KG	BIS(2-CHLOROETHYL) ETHER
850U	UG/KG	HEXACHLOROETHANE
850U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
850U	UG/KG	N-NITROSODI-N-PROPYLAMINE
850U	UG/KG	NITROBENZENE
850U	UG/KG	HEXACHLOROBUTADIENE
480J	UG/KG	2-METHYLNAPHTHALENE
850U	UG/KG	1,2,4-TRICHLOROBENZENE
680J	UG/KG	NAPHTHALENE
850U	UG/KG	4-CHLOROANILINE
850U	UG/KG	BIS(2-CHLOROETHOXY)METHANE
850U	UG/KG	ISOPHORONE
850U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
850U	UG/KG	2-CHLORONAPHTHALENE
850U	UG/KG	2-NITROANILINE
100J	UG/KG	ACENAPHTHYLENE
1200	UG/KG	ACENAPHTHENE
850U	UG/KG	DIMETHYL PHTHALATE
850U	UG/KG	DIBENZOFURAN
850U	UG/KG	2,4-DINITROTOLUENE
850U	UG/KG	2,6-DINITROTOLUENE
850U	UG/KG	3-NITROANILINE
850U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
850U	UG/KG	4-NITROANILINE
1400	UG/KG	FLUORENE
850U	UG/KG	DIETHYL PHTHALATE
850U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
850U	UG/KG	HEXACHLOROBENZENE (HCB)
850U	UG/KG	4-BROMOPHENYL PHENYL ETHER
4500	UG/KG	PHENANTHRENE
1500	UG/KG	ANTHRACENE
850U	UG/KG	DI-N-BUTYLPHTHALATE
5200	UG/KG	FLUORANTHENE
3900	UG/KG	PYRENE
850U	UG/KG	BENZYL BUTYL PHTHALATE
850U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
3200	UG/KG	BENZO(A)ANTHRACENE
2800	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
850U	UG/KG	3,3'-DICHLOROBENZIDINE
850U	UG/KG	DI-N-OCTYLPHTHALATE
2900	UG/KG	BENZO(B)FLUORANTHENE
790J	UG/KG	BENZO(K)FLUORANTHENE
1800	UG/KG	BENZO-A-PYRENE
1500	UG/KG	INDENO (1,2,3-CD) PYRENE
350J	UG/KG	DIBENZO(A,H)ANTHRACENE
1200	UG/KG	BENZO(GH)PERYLENE
850U	UG/KG	2-CHLOROPHENOL
850U	UG/KG	2-METHYLPHENOL
850U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
850U	UG/KG	2-NITROPHENOL
850U	UG/KG	PHENOL
850U	UG/KG	2,4-DIMETHYLPHENOL
850U	UG/KG	2,4-DICHLOROPHENOL
850U	UG/KG	2,4,6-TRICHLOROPHENOL
850U	UG/KG	2,4,5-TRICHLOROPHENOL
850U	UG/KG	4-CHLORO-3-METHYLPHENOL
1700U	UG/KG	2,4-DINITROPHENOL
1700U	UG/KG	2-METHYL-4,6-DINITROPHENOL
1700U	UG/KG	PENTACHLOROPHENOL
1700U	UG/KG	4-NITROPHENOL
850U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
380J	UG/KG	CARBAZOLE
27.1	%	% MOISTURE

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit. R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

1. PREPARED BY: JAMES L. WHITE. 2. DATE: 03/19/98. 3. METHOD: EPA 8210. 4. ANALYST: JAMES L. WHITE. 5. INSTRUMENT: LECO 932. 6. REAGENT: N/A. 7. STANDARD: N/A. 8. CALIBRATION: N/A. 9. QUALITY CONTROL: N/A. 10. NOTES: N/A.

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/19/98 13:36

Sample 2387 FY 1998 Project: 98-0241

EXTRACTABLES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: 25%

Media: SEDIM

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
940U	UG/KG	BIS(2-CHLOROETHYL) ETHER
940U	UG/KG	HEXACHLOROETHANE
940U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
940U	UG/KG	N-NITROSODI-N-PROPYLAMINE
940U	UG/KG	NITROBENZENE
940U	UG/KG	HEXACHLOROBUTADIENE
1000	UG/KG	2-METHYLNAPHTHALENE
940U	UG/KG	1,2,4-TRICHLOROBENZENE
1100	UG/KG	NAPHTHALENE
940U	UG/KG	4-CHLOROANILINE
940U	UG/KG	BIS(2-CHLOROETHOXY)METHANE,
940U	UG/KG	ISOPHORONE
940U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
940U	UG/KG	2-CHLORONAPHTHALENE
940U	UG/KG	2-NITROANILINE
330J	UG/KG	ACENAPHTHYLENE
3200	UG/KG	ACENAPHTHENE
940U	UG/KG	DIMETHYL PHTHALATE
940U	UG/KG	DIBENZOFURAN
940U	UG/KG	2,4-DINITROTOLUENE
940U	UG/KG	2,6-DINITROTOLUENE
940U	UG/KG	3-NITROANILINE
940U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
940U	UG/KG	4-NITROANILINE
3600	UG/KG	FLUORENE
940U	UG/KG	DIETHYL PHTHALATE
940U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
940U	UG/KG	HEXACHLOROBENZENE (HCB)
940U	UG/KG	4-BROMOPHENYL PHENYL ETHER
17000	UG/KG	PHENANTHRENE
4100	UG/KG	ANTHRACENE
940U	UG/KG	DI-N-BUTYLPHTHALATE
19000	UG/KG	FLUORANTHENE
14000	UG/KG	PYRENE
940U	UG/KG	BENZYL BUTYL PHTHALATE
940U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
10000	UG/KG	BENZO(A)ANTHRACENE
7200	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
940U	UG/KG	3,3'-DICHLOROBENZIDINE
940U	UG/KG	DI-N-OCTYLPHTHALATE
8500	UG/KG	BENZO(B)FLUORANTHENE
1800	UG/KG	BENZO(K)FLUORANTHENE
5000	UG/KG	BENZO-A-PYRENE
3900	UG/KG	INDENO (1,2,3-CD) PYRENE
980	UG/KG	DIBENZO(A,H)ANTHRACENE
3100	UG/KG	BENZO(GHI)PERYLENE
940U	UG/KG	2-CHLOROPHENOL
940U	UG/KG	2-METHYLPHENOL
940U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
940U	UG/KG	2-NITROPHENOL
940U	UG/KG	PHENOL
940U	UG/KG	2,4-DIMETHYLPHENOL
940U	UG/KG	2,4-DICHLOROPHENOL
940U	UG/KG	2,4,6-TRICHLOROPHENOL
940U	UG/KG	2,4,5-TRICHLOROPHENOL
940U	UG/KG	4-CHLORO-3-METHYLPHENOL
1900U	UG/KG	2,4-DINITROPHENOL
1900U	UG/KG	2-METHYL-4,6-DINITROPHENOL
1900U	UG/KG	PENTACHLOROPHENOL
1900U	UG/KG	4-NITROPHENOL
940U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
1000	UG/KG	CARBAZOLE
32.4	%	% MOISTURE

A-average value. NA-not analyzed. NAI-Interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by qcms. 1 when no value is reported. see chlordane constituents. 2 constituents of and dieldrin of 1000 ug/kg.

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/12/98 15:27

Sample 2388 FY 1998 Project 98-0241

EXTRACTABLES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: 50%

Media: SEDIM

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
9700U	UG/KG	BIS(2-CHLOROETHYL) ETHER
9700U	UG/KG	HEXACHLOROETHANE
9700U	UG/KG	BIS(2-CHLOROISOPROPYL) ETHER
9700U	UG/KG	N-NITROSODI-N-PROPYLAMINE
9700U	UG/KG	NITROBENZENE
9700U	UG/KG	HEXACHLOROBUTADIENE
4200J	UG/KG	2-METHYLNAPHTHALENE
9700U	UG/KG	1,2,4-TRICHLOROBENZENE
6400J	UG/KG	NAPHTHALENE
9700U	UG/KG	4-CHLOROANILINE
9700U	UG/KG	BIS(2-CHLOROETHOXY)METHANE
9700U	UG/KG	ISOPHORONE
9700U	UG/KG	HEXACHLOROCYCLOPENTADIENE (HCCP)
9700U	UG/KG	2-CHLORONAPHTHALENE
9700U	UG/KG	2-NITROANILINE
1000J	UG/KG	ACENAPHTHYLENE
9700J	UG/KG	ACENAPHTHENE
9700U	UG/KG	DIMETHYL PHTHALATE
4900J	UG/KG	DIBENZOFURAN
9700U	UG/KG	2,4-DINITROTOLUENE
9700U	UG/KG	2,6-DINITROTOLUENE
9700U	UG/KG	3-NITROANILINE
9700U	UG/KG	4-CHLOROPHENYL PHENYL ETHER
9700U	UG/KG	4-NITROANILINE
9700J	UG/KG	FLUORENE
9700U	UG/KG	DIETHYL PHTHALATE
9700U	UG/KG	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
9700U	UG/KG	HEXACHLOROBENZENE (HCB)
9700U	UG/KG	4-BROMOPHENYL PHENYL ETHER
34000	UG/KG	PHENANTHRENE
11000	UG/KG	ANTHRACENE
9700U	UG/KG	DI-N-BUTYLPHTHALATE
39000	UG/KG	FLUORANTHENE
20000	UG/KG	PYRENE
9700U	UG/KG	BENZYL BUTYL PHTHALATE
9700U	UG/KG	BIS(2-ETHYLHEXYL) PHTHALATE
17000	UG/KG	BENZO(A)ANTHRACENE
15000	UG/KG	CHRYSENE

RESULTS	UNITS	ANALYTE
9700U	UG/KG	3,3'-DICHLOROBENZIDINE
9700U	UG/KG	DI-N-OCTYLPHTHALATE
11000	UG/KG	BENZO(B)FLUORANTHENE
8100J	UG/KG	BENZO(K)FLUORANTHENE
12000	UG/KG	BENZO-A-PYRENE
5700J	UG/KG	INDENO (1,2,3-CD) PYRENE
2200J	UG/KG	DIBENZO(A,H)ANTHRACENE
5100J	UG/KG	BENZO(GHI)PERYLENE
9700U	UG/KG	2-CHLOROPHENOL
9700U	UG/KG	2-METHYLPHENOL
9700U	UG/KG	(3-AND/OR 4-)METHYLPHENOL
9700U	UG/KG	2-NITROPHENOL
9700U	UG/KG	PHENOL
9700U	UG/KG	2,4-DIMETHYLPHENOL
9700U	UG/KG	2,4-DICHLOROPHENOL
9700U	UG/KG	2,4,6-TRICHLOROPHENOL
9700U	UG/KG	2,4,5-TRICHLOROPHENOL
9700U	UG/KG	4-CHLORO-3-METHYLPHENOL
19000U	UG/KG	2,4-DINITROPHENOL
19000U	UG/KG	2-METHYL-4,6-DINITROPHENOL
19000U	UG/KG	PENTACHLOROPHENOL
19000U	UG/KG	4-NITROPHENOL
9700U	UG/KG	2,3,4,6-TETRACHLOROPHENOL
18000	UG/KG	CARBAZOLE
35.3	%	% MOISTURE

Average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

L-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit

ng indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

continued the results. 1. When the results of a sample are not reported, the results are not reported. 2. The results are not reported if the results are not reported.

TRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SED, ATHENS, GA

Production Date: 03/12/98 15:27

Sample 2388 FY 1998 Project: 98-0241

MISCELLANEOUS COMPOUNDS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: 50%

Media: SEDIM

Produced by: Dennis Revell

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
10000JN	UG/KG	BENZOFLUORANTHENE (NOT B OR K)

Average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit

5	K8	1.52	<2
5	K9	1.36	<2
5	K10	1.14	<2
5	L3B	0.20	>20
5	L4	-0.13	>20
5	L5	0.05	>20
5	L6	0.28	>20
5	L7	0.30	>20
5	L8	0.34	>20
5	L9	0.61	10 to 20
5	L9 (Rep)	0.58	10 to 20
6	M1	1.45	<0.5
6	M2	0.79	2 to 10
6	M3	1.28	-0.5
6	M4	1.06	-2
6	M5	1.30	-0.5
6	M6	0.09	>20
6	M7	0.61	10
6	M8	0.71	2 to 10
6	M9	0.50	10 to 20
6	M10	1.04	-2
6	N1	0.74	2 to 10
6	N2	1.27	-0.5
6	N2 (Rep)	1.24	-0.5
6	M1 (Rep)	1.30	-2
7	P1	1.03	0.5 to 2
7	P2	0.82	-2
7	P3	0.63	2 to 10
7	P4	0.36	>10
7	P5	1.20	-0.5
7	P6	0.41	>10
7	P7	1.20	-0.5
7	P8	0.96	0.5 to 2
7	P9	1.19	-0.5
7	P10	1.10	-0.5
7	P11	0.53	-10
7	P12	1.05	0.5 to 2
7	P13	1.01	0.5 to 2
7	P14	0.65	2 to 10
7	P15	0.89	-2
7	P16	0.08	>10

Run	Location		Range
1	A1	0.99	2 to 10
1	A2	1.00	2 to 10
1	A3	1.22	0.5 to 2
1	A4	0.26	>10
1	A5	0.77	>10
1	A6	0.10	>10
1	A7	0.47	>10
1	A8	0.77	>10
1	A9	0.42	>10
1	A10	0.40	>10
1	A11	0.56	>10
1	A12	0.59	>10
1	B1	0.57	>10
1	B1 (Rep)	0.58	>10
1	B2	0.61	>10
1	B2 (Rep)	0.63	>10
2	A8 (Dup)	0.65	~10
2	B3	0.50	10 to 20
2	B4	0.54	10 to 20
2	B5	0.57	10 to 20
2	B6	0.92	~2
2	B7	0.56	10 to 20
2	B8	0.61	~10
2	C1	0.34	>20
2	C2	0.04	>20
2	C3	0.71	2 to 10
2	D1	0.30	>20
2	D2	0.47	~20
2	D3	0.77	2 to 10
2	D3 (Dup)	0.69	2 to 10
2	E1	1.02	<2
2	F1	1.03	<2
3	A13	0.76	2 to 10
3	A14	0.66	2 to 10
3	A15	0.97	~2
3	A16	0.92	~2
3	B9	0.44	~20
3	B10	0.54	~10
3	G1	0.90	~2
3	G2	1.00	<2
3	G3	1.02	<2
3	G4	0.90	~2
3	G5	1.05	<2
3	G6	0.94	~2
3	G7	1.06	<2
3	H1	1.24	<2
3	H2	0.82	2 to 10
3	H3	0.05	>20
4	J1	0.61	2 to 10
4	J2	0.51	2 to 10
4	J3	0.69	~2
4	J4	0.64	2 to 10
4	J5	0.35	~10
4	J6	0.34	~10
4	J7	0.52	2 to 10
4	J8	0.78	<2
4	J9	0.69	~2
4	J9 (Dup)	0.70	~2
4	K1	0.70	~2
4	K2	0.46	2 to 10
4	K3	0.89	<2
4	L1	0.83	<2
4	L2	0.74	~2
4	L3	0.11	>20
5	J10	0.89	~2
5	K4	1.11	<2
5	K5	0.84	~2
5	K6	1.02	<2
5	K7	1.36	<2

Table x.

Run	Location		Range
1	A1	0.99	2 to 10
1	A2	1.00	2 to 10
1	A3	1.22	0.5 to 2
1	A4	0.26	>10
1	A5	0.77	>10
1	A6	0.10	>10
1	A7	0.47	>10
1	A8	0.77	>10
1	A9	0.42	>10
1	A10	0.40	>10
1	A11	0.56	>10
1	A12	0.59	>10
1	B1	0.57	>10
1	B1 (Rep)	0.58	>10
1	B2	0.61	>10
1	B2 (Rep)	0.63	>10
2	A8 (Dup)	0.65	~10
2	B3	0.50	10 to 20
2	B4	0.54	10 to 20
2	B5	0.57	10 to 20
2	B6	0.92	~2
2	B7	0.56	10 to 20
2	B8	0.61	~10
2	C1	0.34	>20
2	C2	0.04	>20
2	C3	0.71	2 to 10
2	D1	0.30	>20
2	D2	0.47	~20
2	D3	0.77	2 to 10
2	D3 (Dup)	0.69	2 to 10
2	E1	1.02	<2
2	F1	1.03	<2
3	A13	0.76	2 to 10
3	A14	0.66	2 to 10
3	A15	0.97	~2
3	A16	0.92	~2
3	B9	0.44	~20
3	B10	0.54	~10
3	G1	0.90	~2
3	G2	1.00	<2
3	G3	1.02	<2
3	G4	0.90	~2
3	G5	1.05	<2
3	G6	0.94	~2
3	G7	1.06	<2
3	H1	1.24	<2
3	H2	0.82	2 to 10
3	H3	0.05	>20
4	J1	0.61	2 to 10
4	J2	0.51	2 to 10
4	J3	0.69	~2
4	J4	0.64	2 to 10
4	J5	0.35	~10
4	J6	0.34	~10
4	J7	0.52	2 to 10
4	J8	0.78	<2
4	J9	0.69	~2
4	J9 (Dup)	0.70	~2
4	K1	0.70	~2
4	K2	0.46	2 to 10
4	K3	0.89	<2
4	L1	0.83	<2
4	L2	0.74	~2
4	L3	0.11	>20



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region 4

Science and Ecosystem Support Division
980 College Station Road
Athens, Georgia 30605-2720

MEMORANDUM

Date: 03/19/98

Subject: Results of PESTICIDES/PCB ORGANIC Chemistry Section Sample Analysis
98-0241 Tennessee Products
Chattanooga, TN

*Solid
Sediment*

From: Lavon Revells *LVR*

To: Alan Auwarter

CC: SESD/EAB/EES

Thru: William McDaniel *WMD*
Chief, ORGANIC Chemistry Section

Attached are the results of analysis of samples collected as part of the subject project. If you have any questions, please contact me.

ATTACHMENT

Sample 2374 FY 1998 Project 98-0241

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program SSF

Id/Station REM1

Media: SEDIM

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
7.1U	UG/KG	ALDRIN
7.1U	UG/KG	HEPTACHLOR
7.1U	UG/KG	HEPTACHLOR EPOXIDE
28	UG/KG	ALPHA-BHC
24	UG/KG	BETA-BHC
7.1U	UG/KG	GAMMA-BHC (LINDANE)
4.9N	UG/KG	DELTA-BHC
7.1U	UG/KG	ENDOSULFAN I (ALPHA)
7.1U	UG/KG	DIELDRIN
28U	UG/KG	4,4'-DDT (P,P'-DDT)
7.1U	UG/KG	4,4'-DDE (P,P'-DDE)
18U	UG/KG	4,4'-DDD (P,P'-DDD)
18U	UG/KG	ENDRIN
18U	UG/KG	ENDOSULFAN II (BETA)
18U	UG/KG	ENDOSULFAN SULFATE
45U	UG/KG	CHLORDANE (TECH. MIXTURE) /1
100U	UG/KG	PCB-1242 (AROCLOR 1242)
100U	UG/KG	PCB-1254 (AROCLOR 1254)
100U	UG/KG	PCB-1221 (AROCLOR 1221)
100U	UG/KG	PCB-1232 (AROCLOR 1232)
100U	UG/KG	PCB-1248 (AROCLOR 1248)
100U	UG/KG	PCB-1260 (AROCLOR 1260)
100U	UG/KG	PCB-1016 (AROCLOR 1016)
710U	UG/KG	TOXAPHENE
	UG/KG	CHLORDENE /2
	UG/KG	ALPHA-CHLORDENE /2
	UG/KG	BETA-CHLORDENE /2
	UG/KG	GAMMA-CHLORDENE /2
	UG/KG	1-HYDROXYCHLORDENE /2
	UG/KG	GAMMA-CHLORDANE /2
	UG/KG	TRANS-NONACHLOR /2
	UG/KG	ALPHA-CHLORDANE /2
	UG/KG	CIS-NONACHLOR /2
	UG/KG	OXYCHLORDANE (OCTACHLOREPOXIDE) /2
45U	UG/KG	METHOXYCHLOR
18U	UG/KG	ENDRIN KETONE
33	%	% MOISTURE

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Sample 2375 FY 1998 Project 98-0241

Produced by Lavon Revells

PESTICIDES SCAN

Requestor

Facility Tennessee Products Chattanooga, TN

Project Leader AAUWARTE

Program SSF

Beginning 02/13/98

Id/Station REM2

Ending

Media: SEDIM

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
15U	UG/KG	ALDRIN
15U	UG/KG	HEPTACHLOR
15U	UG/KG	HEPTACHLOR EPOXIDE
130	UG/KG	ALPHA-BHC
27J	UG/KG	BETA-BHC
15U	UG/KG	GAMMA-BHC (LINDANE)
30J	UG/KG	DELTA-BHC
15U	UG/KG	ENDOSULFAN I (ALPHA)
15U	UG/KG	DIELDRIN
39U	UG/KG	4,4'-DDT (P,P'-DDT)
39U	UG/KG	4,4'-DDE (P,P'-DDE)
39U	UG/KG	4,4'-DDD (P,P'-DDD)
59N	UG/KG	ENDRIN
39U	UG/KG	ENDOSULFAN II (BETA)
39U	UG/KG	ENDOSULFAN SULFATE
97U	UG/KG	CHLORDANE (TECH. MIXTURE) /1
190U	UG/KG	PCB-1242 (AROCLOR 1242)
190U	UG/KG	PCB-1254 (AROCLOR 1254)
190U	UG/KG	PCB-1221 (AROCLOR 1221)
190U	UG/KG	PCB-1232 (AROCLOR 1232)
190U	UG/KG	PCB-1248 (AROCLOR 1248)
190U	UG/KG	PCB-1260 (AROCLOR 1260)
190U	UG/KG	PCB-1016 (AROCLOR 1016)
1500U	UG/KG	TOXAPHENE
	UG/KG	CHLORDENE /2
	UG/KG	ALPHA-CHLORDENE /2
	UG/KG	BETA-CHLORDENE /2
	UG/KG	GAMMA-CHLORDENE /2
	UG/KG	1-HYDROXYCHLORDENE /2
	UG/KG	GAMMA-CHLORDANE /2
	UG/KG	TRANS-NONACHLOR /2
	UG/KG	ALPHA-CHLORDANE /2
	UG/KG	CIS-NONACHLOR /2
	UG/KG	OXYCHLORDANE (OCTACHLOREPOXIDE) /2
97U	UG/KG	METHOXYCHLOR
39U	UG/KG	ENDRIN KETONE
21	%	% MOISTURE

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

<-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Minimum reporting level: 0.1 ug/kg for all pesticides except DDT, DDE, DDD, and PCBs which are reported at 0.01 ug/kg. For PCBs, the number in parentheses indicates the number of congeners analyzed.

Production Date: 03/19/98 13:56

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
530U	UG/KG	ALDRIN
530U	UG/KG	HEPTACHLOR
530U	UG/KG	HEPTACHLOR EPOXIDE
510J	UG/KG	ALPHA-BHC
1400J	UG/KG	BETA-BHC
530U	UG/KG	GAMMA-BHC (LINDANE)
1200J	UG/KG	DELTA-BHC
530U	UG/KG	ENDOSULFAN I (ALPHA)
530U	UG/KG	DIELDRIN
1300U	UG/KG	4,4'-DDT (P,P'-DDT)
530U	UG/KG	4,4'-DDE (P,P'-DDE)
1300U	UG/KG	4,4'-DDD (P,P'-DDD)
1300U	UG/KG	ENDRIN
1300U	UG/KG	ENDOSULFAN II (BETA)
1300U	UG/KG	ENDOSULFAN SULFATE
3300U	UG/KG	CHLORDANE (TECH. MIXTURE) /1
6700U	UG/KG	PCB-1242 (AROCOR 1242)
6700U	UG/KG	PCB-1254 (AROCOR 1254)
6700U	UG/KG	PCB-1221 (AROCOR 1221)
6700U	UG/KG	PCB-1232 (AROCOR 1232)
6700U	UG/KG	PCB-1248 (AROCOR 1248)
6700U	UG/KG	PCB-1260 (AROCOR 1260)
6700U	UG/KG	PCB-1016 (AROCOR 1016)
53000U	UG/KG	TOXAPHENE
	UG/KG	CHLORDENE /2
	UG/KG	ALPHA-CHLORDENE /2
	UG/KG	BETA-CHLORDENE /2
	UG/KG	GAMMA-CHLORDENE /2
	UG/KG	1-HYDROXYCHLORDENE /2
	UG/KG	GAMMA-CHLORDANE /2
	UG/KG	TRANS-NONACHLOR /2
	UG/KG	ALPHA-CHLORDANE /2
	UG/KG	CIS-NONACHLOR /2
	UG/KG	OXYCHLORDANE (OCTACHLOREPOXIDE) /2
3300U	UG/KG	METHOXYCHLOR
1300U	UG/KG	ENDRIN KETONE
29	%	% MOISTURE

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material
K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected. the number is the minimum quantitation limit
Z-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

PESTICIDES/PCB SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/19/98 13:56

Sample 2377 FY 1998 Project 98-0241

PESTICIDES SCAN

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station REFERENCE SOIL

Media SOIL

Produced by Lavon Revells

Requestor

Project Leader AAUWARTE

Beginning 02/13/98

Ending

Information on detection limits shortly

RESULTS	UNITS	ANALYTE
6.6U	UG/KG	ALDRIN
6.6U	UG/KG	HEPTACHLOR
6.6U	UG/KG	HEPTACHLOR EPOXIDE
7.2J	UG/KG	ALPHA-BHC
6.6U	UG/KG	BETA-BHC
6.6U	UG/KG	GAMMA-BHC (LINDANE)
6.6U	UG/KG	DELTA-BHC
6.6U	UG/KG	ENDOSULFAN I (ALPHA)
7.4J	UG/KG	DIELDRIN
16U	UG/KG	4,4'-DDT (P,P'-DDT)
16U	UG/KG	4,4'-DDE (P,P'-DDE)
16U	UG/KG	4,4'-DDD (P,P'-DDD)
16U	UG/KG	ENDRIN
16U	UG/KG	ENDOSULFAN II (BETA)
16U	UG/KG	ENDOSULFAN SULFATE
41U	UG/KG	CHLORDANE (TECH. MIXTURE) /1
120U	UG/KG	PCB-1242 (AROCLOR 1242)
120U	UG/KG	PCB-1254 (AROCLOR 1254)
120U	UG/KG	PCB-1221 (AROCLOR 1221)
120U	UG/KG	PCB-1232 (AROCLOR 1232)
120U	UG/KG	PCB-1248 (AROCLOR 1248)
120U	UG/KG	PCB-1260 (AROCLOR 1260)
120U	UG/KG	PCB-1016 (AROCLOR 1016)
660U	UG/KG	TOXAPHENE
	UG/KG	CHLORDENE /2
	UG/KG	ALPHA-CHLORDENE /2
	UG/KG	BETA-CHLORDENE /2
	UG/KG	GAMMA-CHLORDENE /2
	UG/KG	1-HYDROXYCHLORDENE /2
	UG/KG	GAMMA-CHLORDANE /2
	UG/KG	TRANS-NONACHLOR /2
	UG/KG	ALPHA-CHLORDANE /2
	UG/KG	CIS-NONACHLOR /2
	UG/KG	OXYCHLORDANE (OCTACHLOREPOXIDE) /2
7.6J	UG/KG	METHOXYCHLOR
16U	UG/KG	ENDRIN KETONE
23	%	% MOISTURE

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material
 actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit
 qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification
 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.

Sample 2378 FY 1998 Project 98-0241

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program SSF

Id/Station S1

Media: SOIL

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning 02/13/98

Ending:

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 7.3U | UG/KG | ALDRIN |
| 7.3U | UG/KG | HEPTACHLOR |
| 7.3U | UG/KG | HEPTACHLOR EPOXIDE |
| 16 | UG/KG | ALPHA-BHC |
| 6.2J | UG/KG | BETA-BHC |
| 7.3U | UG/KG | GAMMA-BHC (LINDANE) |
| 16U | UG/KG | DELTA-BHC |
| 7.3U | UG/KG | ENDOSULFAN I (ALPHA) |
| 13J | UG/KG | DIELDRIN |
| 30U | UG/KG | 4,4'-DDT (P,P'-DDT) |
| 7.3U | UG/KG | 4,4'-DDE (P,P'-DDE) |
| 2.8J | UG/KG | 4,4'-DDD (P,P'-DDD) |
| 18U | UG/KG | ENDRIN |
| 18U | UG/KG | ENDOSULFAN II (BETA) |
| 29U | UG/KG | ENDOSULFAN SULFATE |
| 46U | UG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 110U | UG/KG | PCB-1242 (AROCLOR 1242) |
| 110U | UG/KG | PCB-1254 (AROCLOR 1254) |
| 110U | UG/KG | PCB-1221 (AROCLOR 1221) |
| 110U | UG/KG | PCB-1232 (AROCLOR 1232) |
| 110U | UG/KG | PCB-1248 (AROCLOR 1248) |
| 110U | UG/KG | PCB-1260 (AROCLOR 1260) |
| 110U | UG/KG | PCB-1016 (AROCLOR 1016) |
| 730U | UG/KG | TOXAPHENE |
| | UG/KG | CHLORDENE /2 |
| | UG/KG | ALPHA-CHLORDENE /2 |
| | UG/KG | BETA-CHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDENE /2 |
| | UG/KG | 1-HYDROXYCHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDANE /2 |
| | UG/KG | TRANS-NONACHLOR /2 |
| | UG/KG | ALPHA-CHLORDANE /2 |
| | UG/KG | CIS-NONACHLOR /2 |
| | UG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 44U | UG/KG | METHOXYCHLOR |
| 18U | UG/KG | ENDRIN KETONE |
| 33 | % | % MOISTURE |

Average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

Actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

confirmed by gcms. 1 when no value is reported. see chlordan constituents. 2 constituents or metabolites of technical chlordan

Sample 2379 FY 1998 Project 98-0241

PESTICIDES SCAN

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station S2

Media SOIL

Produced by Lavon Revells

Requestor

Project Leader AAUWARTE

Beginning 02/13/98

Ending

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 17U | UG/KG | ALDRIN |
| 17U | UG/KG | HEPTACHLOR |
| 17U | UG/KG | HEPTACHLOR EPOXIDE |
| 28 | UG/KG | ALPHA-BHC |
| 34J | UG/KG | BETA-BHC |
| 17U | UG/KG | GAMMA-BHC (LINDANE) |
| 18 | UG/KG | DELTA-BHC |
| 43U | UG/KG | ENDOSULFAN I (ALPHA) |
| 32 | UG/KG | DIELDRIN |
| 75U | UG/KG | 4,4'-DDT (P,P'-DDT) |
| 17U | UG/KG | 4,4'-DDE (P,P'-DDE) |
| 43U | UG/KG | 4,4'-DDD (P,P'-DDD) |
| 43U | UG/KG | ENDRIN |
| 43U | UG/KG | ENDOSULFAN II (BETA) |
| 43U | UG/KG | ENDOSULFAN SULFATE |
| 110U | UG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 290U | UG/KG | PCB-1242 (AROCOR 1242) |
| 290U | UG/KG | PCB-1254 (AROCOR 1254) |
| 290U | UG/KG | PCB-1221 (AROCOR 1221) |
| 290U | UG/KG | PCB-1232 (AROCOR 1232) |
| 290U | UG/KG | PCB-1248 (AROCOR 1248) |
| 290U | UG/KG | PCB-1260 (AROCOR 1260) |
| 290U | UG/KG | PCB-1016 (AROCOR 1016) |
| 1700U | UG/KG | TOXAPHENE |
| | UG/KG | CHLORDENE /2 |
| | UG/KG | ALPHA-CHLORDENE /2 |
| | UG/KG | BETA-CHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDENE /2 |
| | UG/KG | 1-HYDROXYCHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDANE /2 |
| | UG/KG | TRANS-NONACHLOR /2 |
| | UG/KG | ALPHA-CHLORDANE /2 |
| | UG/KG | CIS-NONACHLOR /2 |
| | UG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 120U | UG/KG | METHOXYCHLOR |
| 43U | UG/KG | ENDRIN KETONE |
| 29 | % | % MOISTURE |

A-average value NA-not analyzed. NAI-interferences J-estimated value N-presumptive evidence of presence of material.

L-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit

2-qc indicates that data unusable. compound may or may not be present resampling and reanalysis is necessary for verification

PESTICIDES/PCB SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/19/98 13:56

| | | |
|----|--|---|
| el | Sample 2380 FY 1998 Project 98-0241 | Produced by Lavon Revells |
| R | PESTICIDES SCAN | Requestor |
| | Facility: Tennessee Products Chattanooga, TN | Project Leader: AAUWARTE |
| | Program SSF | Beginning 02/13/98 |
| li | Id/Station S3 | Ending |
| | Media: SOIL | Information on detection limits shortly |

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 9.5U | UG/KG | ALDRIN |
| 9.5U | UG/KG | HEPTACHLOR |
| 9.5U | UG/KG | HEPTACHLOR EPOXIDE |
| 17 | UG/KG | ALPHA-BHC |
| 31 | UG/KG | BETA-BHC |
| 9.5U | UG/KG | GAMMA-BHC (LINDANE) |
| 8.8N | UG/KG | DELTA-BHC |
| 9.5U | UG/KG | ENDOSULFAN I (ALPHA) |
| 48 | UG/KG | DIELDRIN |
| 25N | UG/KG | 4,4'-DDT (P,P'-DDT) |
| 9.5U | UG/KG | 4,4'-DDE (P,P'-DDE) |
| 24U | UG/KG | 4,4'-DDD (P,P'-DDD) |
| 24U | UG/KG | ENDRIN |
| 24U | UG/KG | ENDOSULFAN II (BETA) |
| 24U | UG/KG | ENDOSULFAN SULFATE |
| 60U | UG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 120U | UG/KG | PCB-1242 (AROCLOR 1242) |
| 120U | UG/KG | PCB-1254 (AROCLOR 1254) |
| 120U | UG/KG | PCB-1221 (AROCLOR 1221) |
| 120U | UG/KG | PCB-1232 (AROCLOR 1232) |
| 120U | UG/KG | PCB-1248 (AROCLOR 1248) |
| 120U | UG/KG | PCB-1260 (AROCLOR 1260) |
| 120U | UG/KG | PCB-1016 (AROCLOR 1016) |
| 950U | UG/KG | TOXAPHENE |
| | UG/KG | CHLORDENE /2 |
| | UG/KG | ALPHA-CHLORDENE /2 |
| | UG/KG | BETA-CHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDENE /2 |
| | UG/KG | 1-HYDROXYCHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDANE /2 |
| | UG/KG | TRANS-NONACHLOR /2 |
| | UG/KG | ALPHA-CHLORDANE /2 |
| | UG/KG | CIS-NONACHLOR /2 |
| | UG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 69U | UG/KG | METHOXYCHLOR |
| 24U | UG/KG | ENDRIN KETONE |
| 43 | % | % MOISTURE |

average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

confirms the presence of a substance which is suspected to be chlordanes constituents 2 constituents or metabolites of technical chlordanes

Sample 2381 FY 1998 Project: 98-0241

Produced by: Lavon Revells

PESTICIDES SCAN

Requestor

Facility: Tennessee Products Chattanooga, TN

Project Leader AAUWARTE

Program: SSF

Beginning 02/13/98

Id/Station S4

Ending:

Media: SOIL

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 8.2U | UG/KG | ALDRIN |
| 8.2U | UG/KG | HEPTACHLOR |
| 8.2U | UG/KG | HEPTACHLOR EPOXIDE |
| 13 | UG/KG | ALPHA-BHC |
| 19J | UG/KG | BETA-BHC |
| 8.2U | UG/KG | GAMMA-BHC (LINDANE) |
| 6.1 | UG/KG | DELTA-BHC |
| 8.2U | UG/KG | ENDOSULFAN I (ALPHA) |
| 11J | UG/KG | DIELDRIN |
| 27U | UG/KG | 4,4'-DDT (P,P'-DDT) |
| 8.2U | UG/KG | 4,4'-DDE (P,P'-DDE) |
| 21U | UG/KG | 4,4'-DDD (P,P'-DDD) |
| 21U | UG/KG | ENDRIN |
| 21U | UG/KG | ENDOSULFAN II (BETA) |
| 21U | UG/KG | ENDOSULFAN SULFATE |
| 51U | UG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 100U | UG/KG | PCB-1242 (AROCLOR 1242) |
| 100U | UG/KG | PCB-1254 (AROCLOR 1254) |
| 100U | UG/KG | PCB-1221 (AROCLOR 1221) |
| 100U | UG/KG | PCB-1232 (AROCLOR 1232) |
| 100U | UG/KG | PCB-1248 (AROCLOR 1248) |
| 100U | UG/KG | PCB-1260 (AROCLOR 1260) |
| 100U | UG/KG | PCB-1016 (AROCLOR 1016) |
| 820U | UG/KG | TOXAPHENE |
| | UG/KG | CHLORDENE /2 |
| | UG/KG | ALPHA-CHLORDENE /2 |
| | UG/KG | BETA-CHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDENE /2 |
| | UG/KG | 1-HYDROXYCHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDANE /2 |
| | UG/KG | TRANS-NONACHLOR /2 |
| | UG/KG | ALPHA-CHLORDANE /2 |
| | UG/KG | CIS-NONACHLOR /2 |
| | UG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 49U | UG/KG | METHOXYCHLOR |
| 21U | UG/KG | ENDRIN KETONE |
| 39 | % | % MOISTURE |

1-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

<-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit

?-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Sample 2382 FY 1998 Project 98-0241
PESTICIDES SCAN
 Facility Tennessee Products Chattanooga, TN
 Program SSF
 Id/Station S5
 Media SOIL

Produced by: Lavon Revells
 Requestor
 Project Leader AAUWARTE
 Beginning 02/13/98
 Ending

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 7.6U | UG/KG | ALDRIN |
| 7.6U | UG/KG | HEPTACHLOR |
| 7.6U | UG/KG | HEPTACHLOR EPOXIDE |
| 10 | UG/KG | ALPHA-BHC |
| 18 | UG/KG | BETA-BHC |
| 7.6U | UG/KG | GAMMA-BHC (LINDANE) |
| 7.8JN | UG/KG | DELTA-BHC |
| 7.6U | UG/KG | ENDOSULFAN I (ALPHA) |
| 1.2J | UG/KG | DIELDRIN |
| 19U | UG/KG | 4,4'-DDT (P,P'-DDT) |
| 7.6U | UG/KG | 4,4'-DDE (P,P'-DDE) |
| 19U | UG/KG | 4,4'-DDD (P,P'-DDD) |
| 19U | UG/KG | ENDRIN |
| 19U | UG/KG | ENDOSULFAN II (BETA) |
| 24U | UG/KG | ENDOSULFAN SULFATE |
| 47U | UG/KG | CHLORDANE (TECH MIXTURE) /1 |
| 95U | UG/KG | PCB-1242 (AROCLOR 1242) |
| 95U | UG/KG | PCB-1254 (AROCLOR 1254) |
| 95U | UG/KG | PCB-1221 (AROCLOR 1221) |
| 95U | UG/KG | PCB-1232 (AROCLOR 1232) |
| 95U | UG/KG | PCB-1248 (AROCLOR 1248) |
| 95U | UG/KG | PCB-1260 (AROCLOR 1260) |
| 95U | UG/KG | PCB-1016 (AROCLOR 1016) |
| 760U | UG/KG | TOXAPHENE |
| | UG/KG | CHLORDENE /2 |
| | UG/KG | ALPHA-CHLORDENE /2 |
| | UG/KG | BETA-CHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDENE /2 |
| | UG/KG | 1-HYDROXYCHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDANE /2 |
| | UG/KG | TRANS-NONACHLOR /2 |
| | UG/KG | ALPHA-CHLORDANE /2 |
| | UG/KG | CIS-NONACHLOR /2 |
| | UG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 56U | UG/KG | METHOXYCHLOR |
| 19U | UG/KG | ENDRIN KETONE |
| 34 | % | % MOISTURE |

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
 actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
 ic indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840. 841. 842. 843. 844. 845. 846. 847. 848. 849. 850. 851. 852. 853. 854. 855. 856. 857. 858. 859. 860. 861. 862. 863. 864. 865. 866. 867. 868. 869. 870. 871. 872. 873. 874. 875. 876. 877. 878. 879. 880. 881. 882. 883. 884. 885. 886. 887. 888. 889. 890. 891. 892. 893. 894. 895. 896. 897. 898. 899. 900. 901. 902. 903. 904. 905. 906. 907. 908. 909. 910. 911. 912. 913. 914. 915. 916. 917. 918. 919. 920. 921. 922. 923. 924. 925. 926. 927. 928. 929. 930. 931. 932. 933. 934. 935. 936. 937. 938. 939. 940. 941. 942. 943. 944. 945. 946. 947. 948. 949. 950. 951. 952. 953. 954. 955. 956. 957. 958. 959. 960. 961. 962. 963. 964. 965. 966. 967. 968. 969. 970. 971. 972. 973. 974. 975. 976. 977. 978. 979. 980. 981. 982. 983. 984. 985. 986. 987. 988. 989. 990. 991. 992. 993. 994. 995. 996. 997. 998. 999. 1000.

Sample 2383 FY 1998 Project 98-0241

PESTICIDES SCAN

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station STA

Media SOIL

Produced by Lavon Revells

Requestor

Project Leader AAUWARTE

Beginning 02/13/98

Ending

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 30U | UG/KG | ALDRIN |
| 30U | UG/KG | HEPTACHLOR |
| 30U | UG/KG | HEPTACHLOR EPOXIDE |
| 180 | UG/KG | ALPHA-BHC |
| 48J | UG/KG | BETA-BHC |
| 49N | UG/KG | GAMMA-BHC (LINDANE) |
| 36 | UG/KG | DELTA-BHC |
| 30U | UG/KG | ENDOSULFAN I (ALPHA) |
| 43 | UG/KG | DIELDRIN |
| 95U | UG/KG | 4,4'-DDT (P,P'-DDT) |
| 30U | UG/KG | 4,4'-DDE (P,P'-DDE) |
| 74U | UG/KG | 4,4'-DDD (P,P'-DDD) |
| 74U | UG/KG | ENDRIN |
| 74U | UG/KG | ENDOSULFAN II (BETA) |
| 74U | UG/KG | ENDOSULFAN SULFATE |
| 180U | UG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 430U | UG/KG | PCB-1242 (AROCLOR 1242) |
| 430U | UG/KG | PCB-1254 (AROCLOR 1254) |
| 430U | UG/KG | PCB-1221 (AROCLOR 1221) |
| 430U | UG/KG | PCB-1232 (AROCLOR 1232) |
| 430U | UG/KG | PCB-1248 (AROCLOR 1248) |
| 430U | UG/KG | PCB-1260 (AROCLOR 1260) |
| 430U | UG/KG | PCB-1016 (AROCLOR 1016) |
| 3000U | UG/KG | TOXAPHENE |
| | UG/KG | CHLORDENE /2 |
| | UG/KG | ALPHA-CHLORDENE /2 |
| | UG/KG | BETA-CHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDENE /2 |
| | UG/KG | 1-HYDROXYCHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDANE /2 |
| | UG/KG | TRANS-NONACHLOR /2 |
| | UG/KG | ALPHA-CHLORDANE /2 |
| | UG/KG | CIS-NONACHLOR /2 |
| | UG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 200U | UG/KG | METHOXYCHLOR |
| 74U | UG/KG | ENDRIN KETONE |
| 22 | % | % MOISTURE |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit.

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

1. The following compounds were analyzed: alpha-chlordane, gamma-chlordane, delta-chlordane, epsilon-chlordane, zeta-chlordane, eta-chlordane, theta-chlordane, iota-chlordane, kappa-chlordane, lambda-chlordane, mu-chlordane, nu-chlordane, xi-chlordane, omicron-chlordane, pi-chlordane, rho-chlordane, sigma-chlordane, tau-chlordane, upsilon-chlordane, phi-chlordane, chi-chlordane, psi-chlordane, omega-chlordane.

Sample 2384 FY 1998 Project 98-0241
PESTICIDES SCAN
 Facility Tennessee Products Chattanooga, TN
 Program SSF
 Id/Station REFERENCE
 Media: SEDIM

Produced by Lavon Revells
 Requestor
 Project Leader AAUWARTE
 Beginning 02/13/98
 Ending

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 7.0U | UG/KG | ALDRIN |
| 7.0U | UG/KG | HEPTACHLOR |
| 7.0U | UG/KG | HEPTACHLOR EPOXIDE |
| 2.6J | UG/KG | ALPHA-BHC |
| 7.0U | UG/KG | BETA-BHC |
| 7.0U | UG/KG | GAMMA-BHC (LINDANE) |
| 7.0U | UG/KG | DELTA-BHC |
| 7.0U | UG/KG | ENDOSULFAN I (ALPHA) |
| 46 | UG/KG | DIELDRIN |
| 18U | UG/KG | 4,4'-DDT (P,P'-DDT) |
| 7.0U | UG/KG | 4,4'-DDE (P,P'-DDE) |
| 6.0J | UG/KG | 4,4'-DDD (P,P'-DDD) |
| 18U | UG/KG | ENDRIN |
| 18U | UG/KG | ENDOSULFAN II (BETA) |
| 29U | UG/KG | ENDOSULFAN SULFATE |
| 44U | UG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 89U | UG/KG | PCB-1242 (AROCLOR 1242) |
| 89U | UG/KG | PCB-1254 (AROCLOR 1254) |
| 89U | UG/KG | PCB-1221 (AROCLOR 1221) |
| 89U | UG/KG | PCB-1232 (AROCLOR 1232) |
| 89U | UG/KG | PCB-1248 (AROCLOR 1248) |
| 89U | UG/KG | PCB-1260 (AROCLOR 1260) |
| 89U | UG/KG | PCB-1016 (AROCLOR 1016) |
| 710U | UG/KG | TOXAPHENE |
| | UG/KG | CHLORDENE /2 |
| | UG/KG | ALPHA-CHLORDENE /2 |
| | UG/KG | BETA-CHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDENE /2 |
| | UG/KG | 1-HYDROXYCHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDANE /2 |
| | UG/KG | TRANS-NONACHLOR /2 |
| | UG/KG | ALPHA-CHLORDANE /2 |
| | UG/KG | CIS-NONACHLOR /2 |
| | UG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 40U | UG/KG | METHOXYCHLOR |
| 18U | UG/KG | ENDRIN KETONE |
| 29 | % | % MOISTURE |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Comments on sample: 1. Sample was analyzed for 17 pesticides and 10 PCB congeners. 2. The results for 17 pesticides are shown in the table above. 3. The results for 10 PCB congeners are shown in the table above. 4. The results for 10 PCB congeners are shown in the table above.

Sample 2385 FY 1998 Project 98-0241

PESTICIDES SCAN

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station 6%

Media: SEDIM

Produced by Lavon Revells

Requestor:

Project Leader AAUWARTE

Beginning 02/13/98

Ending:

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 7.2U | UG/KG | ALDRIN |
| 7.2U | UG/KG | HEPTACHLOR |
| 7.2U | UG/KG | HEPTACHLOR EPOXIDE |
| 3.9J | UG/KG | ALPHA-BHC |
| 7.2U | UG/KG | BETA-BHC |
| 7.2U | UG/KG | GAMMA-BHC (LINDANE) |
| 3.0J | UG/KG | DELTA-BHC |
| 7.2U | UG/KG | ENDOSULFAN I (ALPHA) |
| 7.1J | UG/KG | DIELDRIN |
| 39U | UG/KG | 4,4'-DDT (P,P'-DDT) |
| 7.2U | UG/KG | 4,4'-DDE (P,P'-DDE) |
| 18U | UG/KG | 4,4'-DDD (P,P'-DDD) |
| 18U | UG/KG | ENDRIN |
| 18U | UG/KG | ENDOSULFAN II (BETA) |
| 25U | UG/KG | ENDOSULFAN SULFATE |
| 45U | UG/KG | CHLORDANE (TECH MIXTURE) /1 |
| 90U | UG/KG | PCB-1242 (AROCLOR 1242) |
| 90U | UG/KG | PCB-1254 (AROCLOR 1254) |
| 90U | UG/KG | PCB-1221 (AROCLOR 1221) |
| 90U | UG/KG | PCB-1232 (AROCLOR 1232) |
| 90U | UG/KG | PCB-1248 (AROCLOR 1248) |
| 90U | UG/KG | PCB-1260 (AROCLOR 1260) |
| 90U | UG/KG | PCB-1016 (AROCLOR 1016) |
| 720U | UG/KG | TOXAPHENE |
| | UG/KG | CHLORDENE /2 |
| | UG/KG | ALPHA-CHLORDENE /2 |
| | UG/KG | BETA-CHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDENE /2 |
| | UG/KG | 1-HYDROXYCHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDANE /2 |
| | UG/KG | TRANS-NONACHLOR /2 |
| | UG/KG | ALPHA-CHLORDANE /2 |
| | UG/KG | CIS-NONACHLOR /2 |
| | UG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 24 | UG/KG | METHOXYCHLOR |
| 18U | UG/KG | ENDRIN KETONE |
| 29 | % | % MOISTURE |

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

1-when no value is reported, see chlordane constituents. 2-constituents or metabolites of technical chlordane.

Sample 2386 FY 1998 Project 98-0241

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station 12%

Media: SEDIM

Produced by Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning 02/13/98

Ending:

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 6.8U | UG/KG | ALDRIN |
| 6.8U | UG/KG | HEPTACHLOR |
| 6.8U | UG/KG | HEPTACHLOR EPOXIDE |
| 4.6 | UG/KG | ALPHA-BHC |
| 24 | UG/KG | BETA-BHC |
| 6.8U | UG/KG | GAMMA-BHC (LINDANE) |
| 6.1J | UG/KG | DELTA-BHC |
| 6.8U | UG/KG | ENDOSULFAN I (ALPHA) |
| 3.9J | UG/KG | DIELDRIN |
| 17U | UG/KG | 4,4'-DDT (P,P'-DDT) |
| 6.8U | UG/KG | 4,4'-DDE (P,P'-DDE) |
| 17U | UG/KG | 4,4'-DDD (P,P'-DDD) |
| 17U | UG/KG | ENDRIN |
| 17U | UG/KG | ENDOSULFAN II (BETA) |
| 24U | UG/KG | ENDOSULFAN SULFATE |
| 43U | UG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 85U | UG/KG | PCB-1242 (AROCLOR 1242) |
| 85U | UG/KG | PCB-1254 (AROCLOR 1254) |
| 85U | UG/KG | PCB-1221 (AROCLOR 1221) |
| 85U | UG/KG | PCB-1232 (AROCLOR 1232) |
| 85U | UG/KG | PCB-1248 (AROCLOR 1248) |
| 85U | UG/KG | PCB-1260 (AROCLOR 1260) |
| 85U | UG/KG | PCB-1016 (AROCLOR 1016) |
| 680U | UG/KG | TOXAPHENE |
| | UG/KG | CHLORDENE /2 |
| | UG/KG | ALPHA-CHLORDENE /2 |
| | UG/KG | BETA-CHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDENE /2 |
| | UG/KG | 1-HYDROXYCHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDANE /2 |
| | UG/KG | TRANS-NONACHLOR /2 |
| | UG/KG | ALPHA-CHLORDANE /2 |
| | UG/KG | CIS-NONACHLOR /2 |
| | UG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 16N | UG/KG | METHOXYCHLOR |
| 17U | UG/KG | ENDRIN KETONE |
| 27 | % | % MOISTURE |

average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

confirmed by gcms 1 when no value is reported see chlordan constituents 2 constituents or metabolites of technical chlordan

Sample 2387 FY 1998 Project 98-0241

PESTICIDES SCAN

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station 25%

Media: SEDIM

Produced by Lavon Revells

Requestor

Project Leader AAUWARTE

Beginning 02/13/98

Ending

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 19U | UG/KG | ALDRIN |
| 19U | UG/KG | HEPTACHLOR |
| 19U | UG/KG | HEPTACHLOR EPOXIDE |
| 30 | UG/KG | ALPHA-BHC |
| 100 | UG/KG | BETA-BHC |
| 19U | UG/KG | GAMMA-BHC (LINDANE) |
| 21J | UG/KG | DELTA-BHC |
| 19U | UG/KG | ENDOSULFAN I (ALPHA) |
| 8.4J | UG/KG | DIELDRIN |
| 47U | UG/KG | 4,4'-DDT (P,P'-DDT) |
| 19U | UG/KG | 4,4'-DDE (P,P'-DDE) |
| 47U | UG/KG | 4,4'-DDD (P,P'-DDD) |
| 47U | UG/KG | ENDRIN |
| 47U | UG/KG | ENDOSULFAN II (BETA) |
| 47U | UG/KG | ENDOSULFAN SULFATE |
| 120U | UG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 230U | UG/KG | PCB-1242 (AROCLOR 1242) |
| 230U | UG/KG | PCB-1254 (AROCLOR 1254) |
| 230U | UG/KG | PCB-1221 (AROCLOR 1221) |
| 230U | UG/KG | PCB-1232 (AROCLOR 1232) |
| 230U | UG/KG | PCB-1248 (AROCLOR 1248) |
| 230U | UG/KG | PCB-1260 (AROCLOR 1260) |
| 230U | UG/KG | PCB-1016 (AROCLOR 1016) |
| 1900U | UG/KG | TOXAPHENE |
| | UG/KG | CHLORDENE /2 |
| | UG/KG | ALPHA-CHLORDENE /2 |
| | UG/KG | BETA-CHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDENE /2 |
| | UG/KG | 1-HYDROXYCHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDANE /2 |
| | UG/KG | TRANS-NONACHLOR /2 |
| | UG/KG | ALPHA-CHLORDANE /2 |
| | UG/KG | CIS-NONACHLOR /2 |
| | UG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 100U | UG/KG | METHOXYCHLOR |
| 47U | UG/KG | ENDRIN KETONE |
| 32 | % | % MOISTURE |

1-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material

L-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

2-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

3-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

Sample 2388 FY 1998 Project 98-0241

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station 50%

Media: SEDIM

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning 02/13/98

Ending:

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 19U | UG/KG | ALDRIN |
| 19U | UG/KG | HEPTACHLOR |
| 19U | UG/KG | HEPTACHLOR EPOXIDE |
| 34 | UG/KG | ALPHA-BHC |
| 200 | UG/KG | BETA-BHC |
| 19U | UG/KG | GAMMA-BHC (LINDANE) |
| 36J | UG/KG | DELTA-BHC |
| 19U | UG/KG | ENDOSULFAN I (ALPHA) |
| 25U | UG/KG | DIELDRIN |
| 49U | UG/KG | 4,4'-DDT (P,P'-DDT) |
| 19U | UG/KG | 4,4'-DDE (P,P'-DDE) |
| 49U | UG/KG | 4,4'-DDD (P,P'-DDD) |
| 49U | UG/KG | ENDRIN |
| 49U | UG/KG | ENDOSULFAN II (BETA) |
| 49U | UG/KG | ENDOSULFAN SULFATE |
| 120U | UG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 240U | UG/KG | PCB-1242 (AROCOR 1242) |
| 240U | UG/KG | PCB-1254 (AROCOR 1254) |
| 240U | UG/KG | PCB-1221 (AROCOR 1221) |
| 240U | UG/KG | PCB-1232 (AROCOR 1232) |
| 240U | UG/KG | PCB-1248 (AROCOR 1248) |
| 240U | UG/KG | PCB-1260 (AROCOR 1260) |
| 240U | UG/KG | PCB-1016 (AROCOR 1016) |
| 1900U | UG/KG | TOXAPHENE |
| | UG/KG | CHLORDENE /2 |
| | UG/KG | ALPHA-CHLORDENE /2 |
| | UG/KG | BETA-CHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDENE /2 |
| | UG/KG | 1-HYDROXYCHLORDENE /2 |
| | UG/KG | GAMMA-CHLORDANE /2 |
| | UG/KG | TRANS-NONACHLOR /2 |
| | UG/KG | ALPHA-CHLORDANE /2 |
| | UG/KG | CIS-NONACHLOR /2 |
| | UG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 130U | UG/KG | METHOXYCHLOR |
| 49U | UG/KG | ENDRIN KETONE |
| 35 | % | % MOISTURE |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

L-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

1000 ug/kg indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region 4

Science and Ecosystem Support Division
980 College Station Road
Athens, Georgia 30605-2720

MEMORANDUM

Date: 04/20/98

Subject: Results of PESTICIDES/PCB ORGANIC Sample Analysis
98-0270 Tennessee Products
Chattanooga, TN

W. McDaniel

From: Lavon Revells *LR*

To: Alan Auwarter

CC: SESD/EAB/EES

Thru: William McDaniel *W. McDaniel*
Chief, ORGANIC

Attached are the results of analysis of samples collected as part of the subject project. If you have any questions, please contact me.

ATTACHMENT

Sample 2876 FY 1998 Project 98-0270

PESTICIDES SCAN

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station S-5-1

Media WORMS

Produced by Lavon Revells

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 09.15

Ending

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050U | MG/KG | DIELDRIN |
| 0.077U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.062U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.062U | MG/KG | ENDRIN |
| 0.062U | MG/KG | ENDOSULFAN II (BETA) |
| 0.077U | MG/KG | ENDOSULFAN SULFATE |
| 0.20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50U | MG/KG | PCB-1242 (AROCLOR 1242) |
| 0.50U | MG/KG | PCB-1254 (AROCLOR 1254) |
| 0.50U | MG/KG | PCB-1221 (AROCLOR 1221) |
| 0.50U | MG/KG | PCB-1232 (AROCLOR 1232) |
| 0.50U | MG/KG | PCB-1248 (AROCLOR 1248) |
| 0.50U | MG/KG | PCB-1260 (AROCLOR 1260) |
| 0.50U | MG/KG | PCB-1016 (AROCLOR 1016) |
| 3.1U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20U | MG/KG | METHOXYCHLOR |
| 0.077U | MG/KG | ENDRIN KETONE |

average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material
 actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit
 qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Sample 2877 FY 1998 Project 98-0270

PESTICIDES SCAN

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station S-2-1

Media WORMS

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning 03/10/98 09 20

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.037 | MG/KG | HEPTACHLOR |
| 0.062U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.076 | MG/KG | DIELDRIN |
| 0.11U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.088U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.088U | MG/KG | ENDRIN |
| 0.040J | MG/KG | ENDOSULFAN II (BETA) |
| 0.11U | MG/KG | ENDOSULFAN SULFATE |
| 0.27U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.55U | MG/KG | PCB-1242 (AROCOR 1242) |
| 0.55U | MG/KG | PCB-1254 (AROCOR 1254) |
| 0.55U | MG/KG | PCB-1221 (AROCOR 1221) |
| 0.55U | MG/KG | PCB-1232 (AROCOR 1232) |
| 0.55U | MG/KG | PCB-1248 (AROCOR 1248) |
| 0.55U | MG/KG | PCB-1260 (AROCOR 1260) |
| 0.55U | MG/KG | PCB-1016 (AROCOR 1016) |
| 4.4U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.22U | MG/KG | METHOXYCHLOR |
| 0.11U | MG/KG | ENDRIN KETONE |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Sample 2878 FY 1998 Project 98-0270

PESTICIDES SCAN

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station S-4-1

Media WORMS

Produced by Lavon Revells

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 09 25

Ending

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0 050U | MG/KG | ALDRIN |
| 0 050U | MG/KG | HEPTACHLOR |
| 0 050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0 050U | MG/KG | ALPHA-BHC |
| 0 050U | MG/KG | BETA-BHC |
| 0 050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0 050U | MG/KG | DELTA-BHC |
| 0 050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0 050U | MG/KG | DIELDRIN |
| 0 070U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0 050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0 056U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0 056U | MG/KG | ENDRIN |
| 0 056U | MG/KG | ENDOSULFAN II (BETA) |
| 0 070U | MG/KG | ENDOSULFAN SULFATE |
| 0 20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0 50U | MG/KG | PCB-1242 (AROCLOR 1242) |
| 0 50U | MG/KG | PCB-1254 (AROCLOR 1254) |
| 0 50U | MG/KG | PCB-1221 (AROCLOR 1221) |
| 0 50U | MG/KG | PCB-1232 (AROCLOR 1232) |
| 0 50U | MG/KG | PCB-1248 (AROCLOR 1248) |
| 0 50U | MG/KG | PCB-1260 (AROCLOR 1260) |
| 0 50U | MG/KG | PCB-1016 (AROCLOR 1016) |
| 3.0 | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0 20U | MG/KG | METHOXYCHLOR |
| 0 070U | MG/KG | ENDRIN KETONE |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Sample 2879 FY 1998 Project 98-0270

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-3-1

Media: WORMS

Produced by Lavon Revells

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 09:30

Ending

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.049 | MG/KG | DIELDRIN |
| 0.051U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050U | MG/KG | ENDRIN |
| 0.050U | MG/KG | ENDOSULFAN II (BETA) |
| 0.051U | MG/KG | ENDOSULFAN SULFATE |
| 0.20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50U | MG/KG | PCB-1242 (AROCOR 1242) |
| 0.50U | MG/KG | PCB-1254 (AROCOR 1254) |
| 0.50U | MG/KG | PCB-1221 (AROCOR 1221) |
| 0.50U | MG/KG | PCB-1232 (AROCOR 1232) |
| 0.50U | MG/KG | PCB-1248 (AROCOR 1248) |
| 0.50U | MG/KG | PCB-1260 (AROCOR 1260) |
| 0.50U | MG/KG | PCB-1016 (AROCOR 1016) |
| 3.0U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20U | MG/KG | METHOXYCHLOR |
| 0.051U | MG/KG | ENDRIN KETONE |

A-average value NA-not analyzed NAI-interferences J-estimated value N presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Production Date: 04/20/98 09:44

Requestor

Project Leader: AAUWARTE

Beginning 03/10/98 10 00

Ending

i

Media: WORMS

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050U | MG/KG | DIELDRIN |
| 0.063U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.051U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.051U | MG/KG | ENDRIN |
| 0.051U | MG/KG | ENDOSULFAN II (BETA) |
| 0.063U | MG/KG | ENDOSULFAN SULFATE |
| 0.20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50U | MG/KG | PCB-1242 (AROCOR 1242) |
| 0.50U | MG/KG | PCB-1254 (AROCOR 1254) |
| 0.50U | MG/KG | PCB-1221 (AROCOR 1221) |
| 0.50U | MG/KG | PCB-1232 (AROCOR 1232) |
| 0.50U | MG/KG | PCB-1248 (AROCOR 1248) |
| 0.50U | MG/KG | PCB-1260 (AROCOR 1260) |
| 0.50U | MG/KG | PCB-1016 (AROCOR 1016) |
| 3.0U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20U | MG/KG | METHOXYCHLOR |
| 0.063U | MG/KG | ENDRIN KETONE |

average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material
 actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit
 qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Sample 2881 FY 1998 Project: 98-0270
PESTICIDES SCAN
 Facility: Tennessee Products Chattanooga, TN
 Program: SSF
 Id/Station: S-1-1
 Media: WORMS

Produced by: Lavon Revells
 Requestor:
 Project Leader: AAUWARTE
 Beginning: 03/10/98 10:05
 Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050U | MG/KG | DIELDRIN |
| 0.061U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050U | MG/KG | ENDRIN |
| 0.050U | MG/KG | ENDOSULFAN II (BETA) |
| 0.061U | MG/KG | ENDOSULFAN SULFATE |
| 0.20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50U | MG/KG | PCB-1242 (AROCLOR 1242) |
| 0.50U | MG/KG | PCB-1254 (AROCLOR 1254) |
| 0.50U | MG/KG | PCB-1221 (AROCLOR 1221) |
| 0.50U | MG/KG | PCB-1232 (AROCLOR 1232) |
| 0.50U | MG/KG | PCB-1248 (AROCLOR 1248) |
| 0.50U | MG/KG | PCB-1260 (AROCLOR 1260) |
| 0.50U | MG/KG | PCB-1016 (AROCLOR 1016) |
| 3.0U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20U | MG/KG | METHOXYCHLOR |
| 0.061U | MG/KG | ENDRIN KETONE |

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

PESTICIDES/PCB SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 04/20/98 09:44

Sample 2882 FY 1998 Project: 98-0270

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: CONTROL

Media: WORMS

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 10 10

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050UJ | MG/KG | ALDRIN |
| 0.050UJ | MG/KG | HEPTACHLOR |
| 0.050UJ | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050UJ | MG/KG | ALPHA-BHC |
| 0.050UJ | MG/KG | BETA-BHC |
| 0.050UJ | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050UJ | MG/KG | DELTA-BHC |
| 0.050UJ | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050UJ | MG/KG | DIELDRIN |
| 0.056UJ | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050UJ | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050UJ | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050UJ | MG/KG | ENDRIN |
| 0.050UJ | MG/KG | ENDOSULFAN II (BETA) |
| 0.056UJ | MG/KG | ENDOSULFAN SULFATE |
| 0.20UJ | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50UJ | MG/KG | PCB-1242 (AROCLOR 1242) |
| 0.50UJ | MG/KG | PCB-1254 (AROCLOR 1254) |
| 0.50UJ | MG/KG | PCB-1221 (AROCLOR 1221) |
| 0.50UJ | MG/KG | PCB-1232 (AROCLOR 1232) |
| 0.50UJ | MG/KG | PCB-1248 (AROCLOR 1248) |
| 0.50UJ | MG/KG | PCB-1260 (AROCLOR 1260) |
| 0.50UJ | MG/KG | PCB-1016 (AROCLOR 1016) |
| 3.0UJ | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20UJ | MG/KG | METHOXYCHLOR |
| 0.050UJ | MG/KG | ENDRIN KETONE |

QUANT. IS SUSPECT BASED ON QC DATA

average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

confirmed by some 1 when no value is reported the literature compound 2 concentration or information of minimum quantitation

PESTICIDES/PCB SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 04/20/98 09:44

Sample 2883 FY 1998 Project: 98-0270

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-5-2

Media: WORMS

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 10:15

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050U | MG/KG | DIELDRIN |
| 0.050U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050U | MG/KG | ENDRIN |
| 0.050U | MG/KG | ENDOSULFAN II (BETA) |
| 0.050U | MG/KG | ENDOSULFAN SULFATE |
| 0.20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50U | MG/KG | PCB-1242 (AROCLOR 1242) |
| 0.50U | MG/KG | PCB-1254 (AROCLOR 1254) |
| 0.50U | MG/KG | PCB-1221 (AROCLOR 1221) |
| 0.50U | MG/KG | PCB-1232 (AROCLOR 1232) |
| 0.50U | MG/KG | PCB-1248 (AROCLOR 1248) |
| 0.50U | MG/KG | PCB-1260 (AROCLOR 1260) |
| 0.50U | MG/KG | PCB-1016 (AROCLOR 1016) |
| 3.0U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20U | MG/KG | METHOXYCHLOR |
| 0.050U | MG/KG | ENDRIN KETONE |

average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Sample 2884 FY 1998 Project 98-0270

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: TA-1

Media: WORMS

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 11:45

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050U | MG/KG | DIELDRIN |
| 0.054U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050U | MG/KG | ENDRIN |
| 0.050U | MG/KG | ENDOSULFAN II (BETA) |
| 0.054U | MG/KG | ENDOSULFAN SULFATE |
| 0.20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50U | MG/KG | PCB-1242 (AROCLOR 1242) |
| 0.50U | MG/KG | PCB-1254 (AROCLOR 1254) |
| 0.50U | MG/KG | PCB-1221 (AROCLOR 1221) |
| 0.50U | MG/KG | PCB-1232 (AROCLOR 1232) |
| 0.50U | MG/KG | PCB-1248 (AROCLOR 1248) |
| 0.50U | MG/KG | PCB-1260 (AROCLOR 1260) |
| 0.50U | MG/KG | PCB-1016 (AROCLOR 1016) |
| 3.0U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20U | MG/KG | METHOXYCHLOR |
| 0.054U | MG/KG | ENDRIN KETONE |

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

confirmed by gc/ms: 1-when no value is reported, see chlordanes constituents. 2-constituents or metabolites of technical chlordanes.

Sample 2885 FY 1998 Project 98-0270

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-1-2

Media: WORMS

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 11:50

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050UJ | MG/KG | ALDRIN |
| 0.050UJ | MG/KG | HEPTACHLOR |
| 0.050UJ | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050UJ | MG/KG | ALPHA-BHC |
| 0.050UJ | MG/KG | BETA-BHC |
| 0.050UJ | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050UJ | MG/KG | DELTA-BHC |
| 0.050UJ | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050UJ | MG/KG | DIELDRIN |
| 0.054UJ | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050UJ | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050UJ | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050UJ | MG/KG | ENDRIN |
| 0.050UJ | MG/KG | ENDOSULFAN II (BETA) |
| 0.054UJ | MG/KG | ENDOSULFAN SULFATE |
| 0.20UJ | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50UJ | MG/KG | PCB-1242 (AROCLOR 1242) |
| 0.50UJ | MG/KG | PCB-1254 (AROCLOR 1254) |
| 0.50UJ | MG/KG | PCB-1221 (AROCLOR 1221) |
| 0.50UJ | MG/KG | PCB-1232 (AROCLOR 1232) |
| 0.50UJ | MG/KG | PCB-1248 (AROCLOR 1248) |
| 0.50UJ | MG/KG | PCB-1260 (AROCLOR 1260) |
| 0.50UJ | MG/KG | PCB-1016 (AROCLOR 1016) |
| 3.0UJ | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20UJ | MG/KG | METHOXYCHLOR |
| 0.054UJ | MG/KG | ENDRIN KETONE |

QUANT. IS SUSPECT BASED ON QC DATA

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material
 actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit
 qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

Production Date: 04/20/98 09:44

Media: WORMS

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material
actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification
refined to meet the following: 1. quantitated, sample not two constituents. 2. constituents or metabolites of technical chloroform

PESTICIDES/PCB SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 04/20/98 09:44

Sample **2887** FY **1998** Project: **98-0270**

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-3-2

Media: WORMS

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 12:00

Ending:

1

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.062U | MG/KG | DIELDRIN |
| 0.057U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050U | MG/KG | ENDRIN |
| 0.050U | MG/KG | ENDOSULFAN II (BETA) |
| 0.057U | MG/KG | ENDOSULFAN SULFATE |
| 0.20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50U | MG/KG | PCB-1242 (AROCOLOR 1242) |
| 0.50U | MG/KG | PCB-1254 (AROCOLOR 1254) |
| 0.50U | MG/KG | PCB-1221 (AROCOLOR 1221) |
| 0.50U | MG/KG | PCB-1232 (AROCOLOR 1232) |
| 0.50U | MG/KG | PCB-1248 (AROCOLOR 1248) |
| 0.50U | MG/KG | PCB-1260 (AROCOLOR 1260) |
| 0.50U | MG/KG | PCB-1016 (AROCOLOR 1016) |
| 3.0U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20U | MG/KG | METHOXYCHLOR |
| 0.057U | MG/KG | ENDRIN KETONE |

1-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material

Δ-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

-actual value is known to be less than value given. E-actual value is known to be greater than value given. O-material was analyzed.
 }-gc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification.

PESTICIDES/PCB SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 04/20/98 09:44

Sample 2888 FY 1998 Project: 98-0270

Produced by: Lavon Revells

PESTICIDES SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 03/10/98 13:00

Id/Station: S-5-3

Ending:

Media: WORMS

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050U | MG/KG | DIELDRIN |
| 0.050U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050U | MG/KG | ENDRIN |
| 0.050U | MG/KG | ENDOSULFAN II (BETA) |
| 0.050U | MG/KG | ENDOSULFAN SULFATE |
| 0.20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50U | MG/KG | PCB-1242 (AROCLOR 1242) |
| 0.50U | MG/KG | PCB-1254 (AROCLOR 1254) |
| 0.50U | MG/KG | PCB-1221 (AROCLOR 1221) |
| 0.50U | MG/KG | PCB-1232 (AROCLOR 1232) |
| 0.50U | MG/KG | PCB-1248 (AROCLOR 1248) |
| 0.50U | MG/KG | PCB-1260 (AROCLOR 1260) |
| 0.50U | MG/KG | PCB-1016 (AROCLOR 1016) |
| 3.0U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20U | MG/KG | METHOXYCHLOR |
| 0.050U | MG/KG | ENDRIN KETONE |

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

/1=total chlordane. /2=trans-nonachlor, cis-nonachlor, gamma-chlordane, gamma-chlordene, 1-hydroxy-chlordene, oxy-chlordane, methoxy-chlor, toxaphene, and endrin ketone.

Sample 2889 FY 1998 Project 98-0270

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-2-3

Media: WORMS

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 13:05

Ending:

1

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.053U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.094U | MG/KG | DIELDRIN |
| 0.11U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.085U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.085U | MG/KG | ENDRIN |
| 0.085U | MG/KG | ENDOSULFAN II (BETA) |
| 0.11U | MG/KG | ENDOSULFAN SULFATE |
| 0.27U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.53U | MG/KG | PCB-1242 (AROCLOR 1242) |
| 0.53U | MG/KG | PCB-1254 (AROCLOR 1254) |
| 0.53U | MG/KG | PCB-1221 (AROCLOR 1221) |
| 0.53U | MG/KG | PCB-1232 (AROCLOR 1232) |
| 0.53U | MG/KG | PCB-1248 (AROCLOR 1248) |
| 0.53U | MG/KG | PCB-1260 (AROCLOR 1260) |
| 0.53U | MG/KG | PCB-1016 (AROCLOR 1016) |
| 4.2U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.21U | MG/KG | METHOXYCHLOR |
| 0.11U | MG/KG | ENDRIN KETONE |

Average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

Actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

For more information on sampling and analysis procedures, please refer to the EPA Method 8160-8, which is available at the following URL: <http://www.epa.gov/region4/athens/8160-8.pdf>

Sample 2890 FY 1998 Project: 98-0270

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-4-3

Media: WORMS

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 13:10

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050UJ | MG/KG | ALDRIN |
| 0.050UJ | MG/KG | HEPTACHLOR |
| 0.050UJ | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050UJ | MG/KG | ALPHA-BHC |
| 0.050UJ | MG/KG | BETA-BHC |
| 0.050UJ | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050UJ | MG/KG | DELTA-BHC |
| 0.050UJ | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050UJ | MG/KG | DIELDRIN |
| 0.050UJ | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050UJ | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050UJ | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050UJ | MG/KG | ENDRIN |
| 0.050UJ | MG/KG | ENDOSULFAN II (BETA) |
| 0.050UJ | MG/KG | ENDOSULFAN SULFATE |
| 0.20UJ | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50UJ | MG/KG | PCB-1242 (AROCLOR 1242) |
| 0.50UJ | MG/KG | PCB-1254 (AROCLOR 1254) |
| 0.50UJ | MG/KG | PCB-1221 (AROCLOR 1221) |
| 0.50UJ | MG/KG | PCB-1232 (AROCLOR 1232) |
| 0.50UJ | MG/KG | PCB-1248 (AROCLOR 1248) |
| 0.50UJ | MG/KG | PCB-1260 (AROCLOR 1260) |
| 0.50UJ | MG/KG | PCB-1016 (AROCLOR 1016) |
| 3.0UJ | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.26UJ | MG/KG | METHOXYCHLOR |
| 0.050UJ | MG/KG | ENDRIN KETONE |

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

confirmed by gc/ms. 1-when no value is reported, see chlordanes constituents. 2-constituents or metabolites of technical chlordanes.

PESTICIDES/PCB SAMPLE ANALYSIS

EPA - REGION IV SESD, ATHENS, GA

Production Date: 04/20/98 09:44

Sample **2891** FY **1998** Project: **98-0270**

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-3-3

Media: WORMS

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 13:15

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.078U | MG/KG | DIELDRIN |
| 0.071U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.057U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.057U | MG/KG | ENDRIN |
| 0.057U | MG/KG | ENDOSULFAN II (BETA) |
| 0.071U | MG/KG | ENDOSULFAN SULFATE |
| 0.20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50U | MG/KG | PCB-1242 (AROCOLOR 1242) |
| 0.50U | MG/KG | PCB-1254 (AROCOLOR 1254) |
| 0.50U | MG/KG | PCB-1221 (AROCOLOR 1221) |
| 0.50U | MG/KG | PCB-1232 (AROCOLOR 1232) |
| 0.50U | MG/KG | PCB-1248 (AROCOLOR 1248) |
| 0.50U | MG/KG | PCB-1260 (AROCOLOR 1260) |
| 0.50U | MG/KG | PCB-1016 (AROCOLOR 1016) |
| 3.0U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20U | MG/KG | METHOXYCHLOR |
| 0.071U | MG/KG | ENDRIN KETONE |

NA-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

A-average value. NA-not analyzed. NAI-inferences. J-estimated value. N-presumptive evidence of presence of material.
 L-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit

2-gc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

QC indicates that data unusable; compound may or may not be present. Resampling and reanalysis is necessary for confirmation.

Sample 2892 FY 1998 Project 98-0270

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 13:40

Ending:

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: REF-2

Media: WORMS

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050U | MG/KG | DIELDRIN |
| 0.059U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050U | MG/KG | ENDRIN |
| 0.050U | MG/KG | ENDOSULFAN II (BETA) |
| 0.059U | MG/KG | ENDOSULFAN SULFATE |
| 0.20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50U | MG/KG | PCB-1242 (AROCLOR 1242) |
| 0.50U | MG/KG | PCB-1254 (AROCLOR 1254) |
| 0.50U | MG/KG | PCB-1221 (AROCLOR 1221) |
| 0.50U | MG/KG | PCB-1232 (AROCLOR 1232) |
| 0.50U | MG/KG | PCB-1248 (AROCLOR 1248) |
| 0.50U | MG/KG | PCB-1260 (AROCLOR 1260) |
| 0.50U | MG/KG | PCB-1016 (AROCLOR 1016) |
| 3.0U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20U | MG/KG | METHOXYCHLOR |
| 0.059U | MG/KG | ENDRIN KETONE |

Average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

L-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

pc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

1-technical grade. 2-when analyzed as reported. 3-when analyzed as technical grade. 4-when analyzed as technical grade.

Sample 2893 FY 1998 Project: 98-0270

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 13:45

Ending:

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: REF-3

Media: WORMS

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050UJ | MG/KG | ALDRIN |
| 0.050UJ | MG/KG | HEPTACHLOR |
| 0.050UJ | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050UJ | MG/KG | ALPHA-BHC |
| 0.050UJ | MG/KG | BETA-BHC |
| 0.050UJ | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050UJ | MG/KG | DELTA-BHC |
| 0.050UJ | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050UJ | MG/KG | DIELDRIN |
| 0.055UJ | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050UJ | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050UJ | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050UJ | MG/KG | ENDRIN |
| 0.050UJ | MG/KG | ENDOSULFAN II (BETA) |
| 0.055UJ | MG/KG | ENDOSULFAN SULFATE |
| 0.20UJ | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50UJ | MG/KG | PCB-1242 (AROCLOR 1242) |
| 0.50UJ | MG/KG | PCB-1254 (AROCLOR 1254) |
| 0.50UJ | MG/KG | PCB-1221 (AROCLOR 1221) |
| 0.50UJ | MG/KG | PCB-1232 (AROCLOR 1232) |
| 0.50UJ | MG/KG | PCB-1248 (AROCLOR 1248) |
| 0.50UJ | MG/KG | PCB-1260 (AROCLOR 1260) |
| 0.50UJ | MG/KG | PCB-1016 (AROCLOR 1016) |
| 3.0UJ | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20UJ | MG/KG | METHOXYCHLOR |
| 0.055UJ | MG/KG | ENDRIN KETONE |

NANT. IS SUSPECT BASED ON QC DATA

Average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

Actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

QC indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

Confirmed by gram: 1-when no value is reported, see chlordanes constituents. 2-constituents or metabolites of technical chlordanes.

Sample 2894 FY 1998 Project: 98-0270
PESTICIDES SCAN
 Facility: Tennessee Products Chattanooga, TN
 Program: SSF
 Id/Station: TA-2
 Media: WORMS

Produced by: Lavon Revells
 Requestor:
 Project Leader: AAUWARTE
 Beginning: 03/10/98 13:50
 Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050U | MG/KG | DIELDRIN |
| 0.056U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050U | MG/KG | ENDRIN |
| 0.050U | MG/KG | ENDOSULFAN II (BETA) |
| 0.056U | MG/KG | ENDOSULFAN SULFATE |
| 0.20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50U | MG/KG | PCB-1242 (AROCLOR 1242) |
| 0.50U | MG/KG | PCB-1254 (AROCLOR 1254) |
| 0.50U | MG/KG | PCB-1221 (AROCLOR 1221) |
| 0.50U | MG/KG | PCB-1232 (AROCLOR 1232) |
| 0.50U | MG/KG | PCB-1248 (AROCLOR 1248) |
| 0.50U | MG/KG | PCB-1260 (AROCLOR 1260) |
| 0.50U | MG/KG | PCB-1016 (AROCLOR 1016) |
| 3.0U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20U | MG/KG | METHOXYCHLOR |
| 0.056U | MG/KG | ENDRIN KETONE |

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
 actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
 pc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

PESTICIDES/PCB SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 04/20/98 09:44

Sample 2895 FY 1998 Project 98-0270

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-1-3

Media: WORMS

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 13:55

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050U | MG/KG | DIELDRIN |
| 0.060U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050U | MG/KG | ENDRIN |
| 0.050U | MG/KG | ENDOSULFAN II (BETA) |
| 0.060U | MG/KG | ENDOSULFAN SULFATE |
| 0.20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50U | MG/KG | PCB-1242 (AROCOR 1242) |
| 0.50U | MG/KG | PCB-1254 (AROCOR 1254) |
| 0.50U | MG/KG | PCB-1221 (AROCOR 1221) |
| 0.50U | MG/KG | PCB-1232 (AROCOR 1232) |
| 0.50U | MG/KG | PCB-1248 (AROCOR 1248) |
| 0.50U | MG/KG | PCB-1260 (AROCOR 1260) |
| 0.50U | MG/KG | PCB-1016 (AROCOR 1016) |
| 3.0U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20U | MG/KG | METHOXYCHLOR |
| 0.060U | MG/KG | ENDRIN KETONE |

Average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

Actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

NA indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Referenced by name: 1-when no values reported 2-when data is consistent 3-when data is inconsistent 4-when data is inconsistent 5-when data is inconsistent 6-when data is inconsistent 7-when data is inconsistent 8-when data is inconsistent 9-when data is inconsistent 10-when data is inconsistent

Sample 2896 FY 1998 Project: 98-0270

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: REF-1

Media: WORMS

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 14:10

Ending:

1

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.050U | MG/KG | ALDRIN |
| 0.050U | MG/KG | HEPTACHLOR |
| 0.050U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.050U | MG/KG | ALPHA-BHC |
| 0.050U | MG/KG | BETA-BHC |
| 0.050U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.050U | MG/KG | DELTA-BHC |
| 0.050U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.050U | MG/KG | DIELDRIN |
| 0.054U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.050U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.050U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.050U | MG/KG | ENDRIN |
| 0.050U | MG/KG | ENDOSULFAN II (BETA) |
| 0.054U | MG/KG | ENDOSULFAN SULFATE |
| 0.20U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.50U | MG/KG | PCB-1242 (AROCOR 1242) |
| 0.50U | MG/KG | PCB-1254 (AROCOR 1254) |
| 0.50U | MG/KG | PCB-1221 (AROCOR 1221) |
| 0.50U | MG/KG | PCB-1232 (AROCOR 1232) |
| 0.50U | MG/KG | PCB-1248 (AROCOR 1248) |
| 0.50U | MG/KG | PCB-1260 (AROCOR 1260) |
| 0.50U | MG/KG | PCB-1016 (AROCOR 1016) |
| 3.0U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.20U | MG/KG | METHOXYCHLOR |
| 0.054U | MG/KG | ENDRIN KETONE |

1-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

<-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

2-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

3-confirmed by gc/ms. 1 when no value is reported. see chlordan constituents. 2 constituents or metabolites of technical chlordan.

Sample 2897 FY 1998 Project: 98-0270

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 14:15

Ending:

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: TA-3

Media: WORMS

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.056U | MG/KG | ALDRIN |
| 0.056U | MG/KG | HEPTACHLOR |
| 0.056U | MG/KG | HEPTACHLOR EPOXIDE |
| 0.056U | MG/KG | ALPHA-BHC |
| 0.056U | MG/KG | BETA-BHC |
| 0.056U | MG/KG | GAMMA-BHC (LINDANE) |
| 0.056U | MG/KG | DELTA-BHC |
| 0.056U | MG/KG | ENDOSULFAN I (ALPHA) |
| 0.056U | MG/KG | DIELDRIN |
| 0.14U | MG/KG | 4,4'-DDT (P,P'-DDT) |
| 0.056U | MG/KG | 4,4'-DDE (P,P'-DDE) |
| 0.14U | MG/KG | 4,4'-DDD (P,P'-DDD) |
| 0.14U | MG/KG | ENDRIN |
| 0.14U | MG/KG | ENDOSULFAN II (BETA) |
| 0.14U | MG/KG | ENDOSULFAN SULFATE |
| 0.35U | MG/KG | CHLORDANE (TECH. MIXTURE) /1 |
| 0.71U | MG/KG | PCB-1242 (AROCOR 1242) |
| 0.71U | MG/KG | PCB-1254 (AROCOR 1254) |
| 0.71U | MG/KG | PCB-1221 (AROCOR 1221) |
| 0.71U | MG/KG | PCB-1232 (AROCOR 1232) |
| 0.71U | MG/KG | PCB-1248 (AROCOR 1248) |
| 0.71U | MG/KG | PCB-1260 (AROCOR 1260) |
| 0.71U | MG/KG | PCB-1016 (AROCOR 1016) |
| 5.6U | MG/KG | TOXAPHENE |
| | MG/KG | CHLORDENE /2 |
| | MG/KG | ALPHA-CHLORDENE /2 |
| | MG/KG | BETA-CHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDENE /2 |
| | MG/KG | 1-HYDROXYCHLORDENE /2 |
| | MG/KG | GAMMA-CHLORDANE /2 |
| | MG/KG | TRANS-NONACHLOR /2 |
| | MG/KG | ALPHA-CHLORDANE /2 |
| | MG/KG | CIS-NONACHLOR /2 |
| | MG/KG | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.28U | MG/KG | METHOXYCHLOR |
| 0.056U | MG/KG | ENDRIN KETONE |

A average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Sample 2899 FY 1998 Project 98-0270

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: DIB-2

Media: DRY ICE BLANK

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 09:45

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.020U | UG/BO | ALDRIN |
| 0.020U | UG/BO | HEPTACHLOR |
| 0.020U | UG/BO | HEPTACHLOR EPOXIDE |
| 0.020U | UG/BO | ALPHA-BHC |
| 0.020U | UG/BO | BETA-BHC |
| 0.020U | UG/BO | GAMMA-BHC (LINDANE) |
| 0.020U | UG/BO | DELTA-BHC |
| 0.020U | UG/BO | ENDOSULFAN I (ALPHA) |
| 0.020U | UG/BO | DIELDRIN |
| 0.050U | UG/BO | 4,4'-DDT (P,P'-DDT) |
| 0.020U | UG/BO | 4,4'-DDE (P,P'-DDE) |
| 0.040U | UG/BO | 4,4'-DDD (P,P'-DDD) |
| 0.040U | UG/BO | ENDRIN |
| 0.040U | UG/BO | ENDOSULFAN II (BETA) |
| 0.050U | UG/BO | ENDOSULFAN SULFATE |
| 0.13U | UG/BO | CHLORDANE (TECH. MIXTURE) /1 |
| 0.25U | UG/BO | PCB-1242 (AROCLOR 1242) |
| 0.25U | UG/BO | PCB-1254 (AROCLOR 1254) |
| 0.25U | UG/BO | PCB-1221 (AROCLOR 1221) |
| 0.25U | UG/BO | PCB-1232 (AROCLOR 1232) |
| 0.25U | UG/BO | PCB-1248 (AROCLOR 1248) |
| 0.25U | UG/BO | PCB-1260 (AROCLOR 1260) |
| 0.25U | UG/BO | PCB-1016 (AROCLOR 1016) |
| 2.0U | UG/BO | TOXAPHENE |
| | UG/BO | CHLORDENE /2 |
| | UG/BO | ALPHA-CHLORDENE /2 |
| | UG/BO | BETA-CHLORDENE /2 |
| | UG/BO | GAMMA-CHLORDENE /2 |
| | UG/BO | 1-HYDROXYCHLORDENE /2 |
| | UG/BO | GAMMA-CHLORDANE /2 |
| | UG/BO | TRANS-NONACHLOR /2 |
| | UG/BO | ALPHA-CHLORDANE /2 |
| | UG/BO | CIS-NONACHLOR /2 |
| | UG/BO | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.10U | UG/BO | METHOXYCHLOR |
| 0.050U | UG/BO | ENDRIN KETONE |

average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material

actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit.

qc indicates that data unusable. compound may or may not be present resampling and reanalysis is necessary for verification

indicated by qc. 1 indicates that data is unusable. 2 indicates that data is unusable. 3 indicates that data is unusable. 4 indicates that data is unusable. 5 indicates that data is unusable. 6 indicates that data is unusable. 7 indicates that data is unusable. 8 indicates that data is unusable. 9 indicates that data is unusable.

PESTICIDES/PCB SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 04/20/98 09:44

Sample 2901 FY 1998 Project: 98-0270

PESTICIDES SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: BB-2

Media: BLENDER BLANK

Produced by: Lavon Revells

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 09:55

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.020U | UG/BO | ALDRIN |
| 0.020U | UG/BO | HEPTACHLOR |
| 0.020U | UG/BO | HEPTACHLOR EPOXIDE |
| 0.020U | UG/BO | ALPHA-BHC |
| 0.020U | UG/BO | BETA-BHC |
| 0.020U | UG/BO | GAMMA-BHC (LINDANE) |
| 0.020U | UG/BO | DELTA-BHC |
| 0.020U | UG/BO | ENDOSULFAN I (ALPHA) |
| 0.020U | UG/BO | DIELDRIN |
| 0.050U | UG/BO | 4,4'-DDT (P,P'-DDT) |
| 0.020U | UG/BO | 4,4'-DDE (P,P'-DDE) |
| 0.040U | UG/BO | 4,4'-DDD (P,P'-DDD) |
| 0.040U | UG/BO | ENDRIN |
| 0.040U | UG/BO | ENDOSULFAN II (BETA) |
| 0.050U | UG/BO | ENDOSULFAN SULFATE |
| 0.13U | UG/BO | CHLORDANE (TECH. MIXTURE) /1 |
| 0.25U | UG/BO | PCB-1242 (AROCOLOR 1242) |
| 0.25U | UG/BO | PCB-1254 (AROCOLOR 1254) |
| 0.25U | UG/BO | PCB-1221 (AROCOLOR 1221) |
| 0.25U | UG/BO | PCB-1232 (AROCOLOR 1232) |
| 0.25U | UG/BO | PCB-1248 (AROCOLOR 1248) |
| 0.25U | UG/BO | PCB-1260 (AROCOLOR 1260) |
| 0.25U | UG/BO | PCB-1016 (AROCOLOR 1016) |
| 2.0U | UG/BO | TOXAPHENE |
| | UG/BO | CHLORDENE /2 |
| | UG/BO | ALPHA-CHLORDENE /2 |
| | UG/BO | BETA-CHLORDENE /2 |
| | UG/BO | GAMMA-CHLORDENE /2 |
| | UG/BO | 1-HYDROXYCHLORDENE /2 |
| | UG/BO | GAMMA-CHLORDANE /2 |
| | UG/BO | TRANS-NONACHLOR /2 |
| | UG/BO | ALPHA-CHLORDANE /2 |
| | UG/BO | CIS-NONACHLOR /2 |
| | UG/BO | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| 0.10U | UG/BO | METHOXYCHLOR |
| 0.050U | UG/BO | ENDRIN KETONE |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

A-average value. NA-not analyzed. NAI-inferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

R-actual value is known to be less than value given. E-actual value is known to be greater than value given. S material was analyzed. R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 104



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region 4

**Science and Ecosystem Support Division
980 College Station Road
Athens, Georgia 30605-2720**

MEMORANDUM

Date: 03/23/98

Subject: Results of PESTICIDES/PCB ORGANIC Chemistry Section Sample Analysis
98-0270 Tennessee Products
Chattanooga, TN

*Equine
Line
blanc*

From: Lavon Revells *HR*

To: Alan Auwarter

CC: SESD/EAB/EES

Thru: William McDaniel *W. McDaniel*
Chief, ORGANIC Chemistry Section

Attached are the results of analysis of samples collected as part of the subject project. If you have any questions, please contact me.

ATTACHMENT

Sample 2904 FY 1998 Project 98-0270
PESTICIDES SCAN
 Facility Tennessee Products Chattanooga, TN
 Program SSF
 Id/Station ERB-2
 Media EQUIP RINSE BLANK

Produced by Lavon Revells
 Requestor
 Project Leader AAUWARTE
 Beginning 03/10/98 15 10
 Ending

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------------------------------|
| 0.10U | UG/L | ALDRIN |
| 0.10U | UG/L | HEPTACHLOR |
| 0.10U | UG/L | HEPTACHLOR EPOXIDE |
| 0.10U | UG/L | ALPHA-BHC |
| 0.10U | UG/L | BETA-BHC |
| 0.10U | UG/L | GAMMA-BHC (LINDANE) |
| 0.10U | UG/L | DELTA-BHC |
| 0.10U | UG/L | ENDOSULFAN I (ALPHA) |
| 0.10U | UG/L | DIELDRIN |
| 0.10U | UG/L | 4,4'-DDT (P,P'-DDT) |
| 0.10U | UG/L | 4,4'-DDE (P,P'-DDE) |
| 0.10U | UG/L | 4,4'-DDD (P,P'-DDD) |
| 0.10U | UG/L | ENDRIN |
| 0.10U | UG/L | ENDOSULFAN II (BETA) |
| 0.10U | UG/L | ENDOSULFAN SULFATE |
| 0.25U | UG/L | CHLORDANE (TECH MIXTURE) /1 |
| 0.50U | UG/L | PCB-1242 (AROCLOR 1242) |
| 0.50U | UG/L | PCB-1254 (AROCLOR 1254) |
| 0.50U | UG/L | PCB-1221 (AROCLOR 1221) |
| 0.50U | UG/L | PCB-1232 (AROCLOR 1232) |
| 0.50U | UG/L | PCB-1248 (AROCLOR 1248) |
| 0.50U | UG/L | PCB-1260 (AROCLOR 1260) |
| 0.50U | UG/L | PCB-1016 (AROCLOR 1016) |
| 5.0U | UG/L | TOXAPHENE |
| | UG/L | CHLORDENE /2 |
| | UG/L | ALPHA-CHLORDENE /2 |
| | UG/L | BETA-CHLORDENE /2 |
| | UG/L | GAMMA-CHLORDENE /2 |
| | UG/L | 1-HYDROXYCHLORDENE /2 |
| | UG/L | GAMMA-CHLORDANE /2 |
| | UG/L | TRANS-NONACHLOR /2 |
| | UG/L | ALPHA-CHLORDANE /2 |
| | UG/L | CIS-NONACHLOR /2 |
| | UG/L | OXYCHLORDANE (OCTACHLOREPOXIDE) /2 |
| | | METHOXYCHLOR |
| | | ENDRIN KETONE |

* estimated value N-presumptive evidence of presence of material

* value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

* present resampling and reanalysis is necessary for verification

Reference: 2-1-1988 EPA Method 8131-1, 1988 EPA Method 8131-2



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region 4

**Science and Ecosystem Support Division
980 College Station Road
Athens, Georgia 30605-2720**

MEMORANDUM

Date: 03/30/98

Subject: Results of EXTRACTABLES ORGANIC Chemistry Section Sample Analysis
98-0270 Tennessee Products
Chattanooga, TN

*% lipids
for worms*

From: Sam Dutton *Sam Dutton*

To: Alan Auwarter

CC: SESD/EAB/EES

Thru: William McDaniel *William McDaniel*
Chief, ORGANIC Chemistry Section

Attached are the results of analysis of samples collected as part of the subject project. If you have any questions, please contact me.

ATTACHMENT

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2876 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station S-5-1

Media WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 09 15

Ending

I

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 5 | | % LIPIDS |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

This document is to be used to report the results of laboratory tests performed on environmental samples. It is not to be used as a record of the analytical process or as a basis for legal action.

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2877 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station: S-2-1

Media. WORMS

Produced by Sam Dutton

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 09:20

Ending:

1

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 5.3 | | % LIPIDS |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2878 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga TN

Program SSF

Id/Station S-4-1

Media WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 09 25

Ending

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 4.9 | | % LIPIDS |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SED, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2879 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station S-3-1

Media: WORMS

Produced by: Sam Dutton

Requestor:

Project Leader AAUWARTE

Beginning 03/10/98 09:30

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 7.2 | | % LIPIDS |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U material was analyzed for but not detected the number is the minimum quantitation limit

B as indicated that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

continued from page 1. Data on values reported for detection only. Methods: 1. CONTINUOUS OR DISCRETE AT TECHNICAL CONCENTRATION

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2880 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station S-4-2

Media WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 10 00

Ending

I

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 4.6 | | % LIPIDS |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

C-estimated by chromatogram or by other means (e.g., GC/MS) D-estimated by chromatogram or by other means (e.g., GC/MS) E-estimated by chromatogram or by other means (e.g., GC/MS)

Sample 2374 FY 1998 Project 98-0241

Produced by Mike Wasko

METALS SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station REM1

Ending:

Media: SEDIM

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 3.6 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 66 | MG/KG | BARIUM |
| 0.65 | MG/KG | BERYLLIUM |
| 0.32 | MG/KG | CADMIUM |
| 8.9 | MG/KG | COBALT |
| 22 | MG/KG | CHROMIUM |
| 8.9 | MG/KG | COPPER |
| 1.0U | MG/KG | MOLYBDENUM |
| 14 | MG/KG | NICKEL |
| 17 | MG/KG | LEAD |
| 0.20U | MG/KG | ANTIMONY |
| 0.59 | MG/KG | SELENIUM |
| 5.0U | MG/KG | TIN |
| 9.5 | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 68A | MG/KG | TITANIUM |
| 0.21 | MG/KG | THALLIUM |
| 22 | MG/KG | VANADIUM |
| 9.7 | MG/KG | YTTRIUM |
| 42 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.06 | MG/KG | TOTAL MERCURY |
| 13000 | MG/KG | ALUMINUM |
| 400 | MG/KG | MANGANESE |
| 4400 | MG/KG | CALCIUM |
| 1000 | MG/KG | MAGNESIUM |
| 15000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 800 | MG/KG | POTASSIUM |
| 30 | % | % MOISTURE |

-average value NA-not analyzed NAI-interferences U-estimated value N-presumptive evidence of presence of material

actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

confirmed by gcms: 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

Sample 2375 FY 1998 Project 98-0241

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: REM2

Media: SEDIM

Produced by: Mike Wasko

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 4.0 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 52 | MG/KG | BARIUM |
| 0.76 | MG/KG | BERYLLIUM |
| 0.41 | MG/KG | CADMIUM |
| 10 | MG/KG | COBALT |
| 50 | MG/KG | CHROMIUM |
| 15 | MG/KG | COPPER |
| 1.0U | MG/KG | MOLYBDENUM |
| 16 | MG/KG | NICKEL |
| 32A | MG/KG | LEAD |
| 0.20U | MG/KG | ANTIMONY |
| 0.70U | MG/KG | SELENIUM |
| 10U | MG/KG | TIN |
| 16 | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 58 | MG/KG | TITANIUM |
| 0.20U | MG/KG | THALLIUM |
| 20 | MG/KG | VANADIUM |
| 8.3 | MG/KG | YTTRIUM |
| 71 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.14 | MG/KG | TOTAL MERCURY |
| 9700 | MG/KG | ALUMINUM |
| 520 | MG/KG | MANGANESE |
| 13000 | MG/KG | CALCIUM |
| 1700 | MG/KG | MAGNESIUM |
| 18000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 920 | MG/KG | POTASSIUM |
| 23 | % | % MOISTURE |

-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

firmed by gcms 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

Sample 2376 FY 1998 Project 98-0241

Produced by Mike Wasko

METALS SCAN

Requestor

Facility: Tennessee Products Chattanooga, TN

Project Leader AAUWARTE

Program: SSF

Beginning 02/13/98

Id/Station: ACTR

Ending:

Media: SEDIM

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 4.3 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 34 | MG/KG | BARIUM |
| 0.42 | MG/KG | BERYLLIUM |
| 0.26 | MG/KG | CADMIUM |
| 7.6 | MG/KG | COBALT |
| 56 | MG/KG | CHROMIUM |
| 14 | MG/KG | COPPER |
| 1.0U | MG/KG | MOLYBDENUM |
| 12 | MG/KG | NICKEL |
| 50A | MG/KG | LEAD |
| 0.40U | MG/KG | ANTIMONY |
| 0.50U | MG/KG | SELENIUM |
| 22A | MG/KG | TIN |
| 14 | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 56 | MG/KG | TITANIUM |
| 0.20U | MG/KG | THALLIUM |
| 12 | MG/KG | VANADIUM |
| 4.1 | MG/KG | YTTRIUM |
| 70 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.08 | MG/KG | TOTAL MERCURY |
| 3600 | MG/KG | ALUMINUM |
| 330 | MG/KG | MANGANESE |
| 1800 | MG/KG | CALCIUM |
| 420 | MG/KG | MAGNESIUM |
| 12000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 360 | MG/KG | POTASSIUM |
| 40 | % | % MOISTURE |

average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

qc in 2s that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

correction factor gcms 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

Sample 2377 FY 1998 Project: 98-0241

Produced by: Mike Wasko

METALS SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station REFERENCE SOIL

Ending:

Media: SOIL

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 5.8 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 78 | MG/KG | BARIUM |
| 0.77 | MG/KG | BERYLLIUM |
| 0.46 | MG/KG | CADMIUM |
| 15 | MG/KG | COBALT |
| 30 | MG/KG | CHROMIUM |
| 16 | MG/KG | COPPER |
| 1.0U | MG/KG | MOLYBDENUM |
| 21 | MG/KG | NICKEL |
| 59 | MG/KG | LEAD |
| 0.20U | MG/KG | ANTIMONY |
| 0.78 | MG/KG | SELENIUM |
| 5.0U | MG/KG | TIN |
| 21 | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 58 | MG/KG | TITANIUM |
| 0.20U | MG/KG | THALLIUM |
| 22 | MG/KG | VANADIUM |
| 9.1 | MG/KG | YTTRIUM |
| 97 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.12 | MG/KG | TOTAL MERCURY |
| 12000 | MG/KG | ALUMINUM |
| 840 | MG/KG | MANGANESE |
| 1900 | MG/KG | CALCIUM |
| 1000 | MG/KG | MAGNESIUM |
| 16000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 920 | MG/KG | POTASSIUM |
| 23 | % | % MOISTURE |

A - average value NA not analyzed NAI interferences J - estimated value N - presumptive evidence of presence of material

L - actual value is known to be less than value given L - actual value is known to be greater than value given U - material was analyzed for but not detected the number is the minimum quantitation limit

indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

med by gcms 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/23/98 07:59

Sample 2378 FY 1998 Project 98-0241
METALS SCAN
 Facility: Tennessee Products Chattanooga, TN
 Program: SSF
 Id/Station: S1
 Media: SOIL

Produced by: Mike Wasko
 Requestor:
 Project Leader: AAUWARTE
 Beginning 02/13/98
 Ending:

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 10 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 130 | MG/KG | BARIUM |
| 1.2 | MG/KG | BERYLLIUM |
| 0.57 | MG/KG | CADMIUM |
| 22 | MG/KG | COBALT |
| 68 | MG/KG | CHROMIUM |
| 32 | MG/KG | COPPER |
| 1.0 | MG/KG | MOLYBDENUM |
| 37 | MG/KG | NICKEL |
| 74 | MG/KG | LEAD |
| 0.22 | MG/KG | ANTIMONY |
| 1.5 | MG/KG | SELENIUM |
| 5.0U | MG/KG | TIN |
| 16 | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 80 | MG/KG | TITANIUM |
| 0.25 | MG/KG | THALLIUM |
| 34 | MG/KG | VANADIUM |
| 14 | MG/KG | YTTRIUM |
| 160 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.33 | MG/KG | TOTAL MERCURY |
| 20000 | MG/KG | ALUMINUM |
| 2100 | MG/KG | MANGANESE |
| 2400 | MG/KG | CALCIUM |
| 1600 | MG/KG | MAGNESIUM |
| 25000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 1200 | MG/KG | POTASSIUM |
| 30 | % | % MOISTURE |

A average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

* indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Method by gc/ms 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

Sample 2379 FY 1998 Project 98-0241

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program SSF

Id/Station: S2

Media: SOIL

Produced by: Mike Wasko

Requestor:

Project Leader AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 11 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 120 | MG/KG | BARIUM |
| 1.1 | MG/KG | BERYLLIUM |
| 0.69 | MG/KG | CADMIUM |
| 21 | MG/KG | COBALT |
| 69 | MG/KG | CHROMIUM |
| 35 | MG/KG | COPPER |
| 1.0 | MG/KG | MOLYBDENUM |
| 31 | MG/KG | NICKEL |
| 80 | MG/KG | LEAD |
| 0.30 | MG/KG | ANTIMONY |
| 1.6 | MG/KG | SELENIUM |
| 5.0U | MG/KG | TIN |
| 15 | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 86 | MG/KG | TITANIUM |
| 0.20U | MG/KG | THALLIUM |
| 31 | MG/KG | VANADIUM |
| 13 | MG/KG | YTTRIUM |
| 170 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.40 | MG/KG | TOTAL MERCURY |
| 18000 | MG/KG | ALUMINUM |
| 1300 | MG/KG | MANGANESE |
| 2200 | MG/KG | CALCIUM |
| 1400 | MG/KG | MAGNESIUM |
| 23000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 1300 | MG/KG | POTASSIUM |
| 30 | % | % MOISTURE |

Average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

F-cases that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

1 by gcms 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

Sample 2380 FY 1998 Project 98-0241

Produced by: Mike Wasko

METALS SCAN

Requestor:

Facility Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station S3

Ending:

Media: SOIL

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 12 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 110 | MG/KG | BARIUM |
| 0.13 | MG/KG | BERYLLIUM |
| 0.73 | MG/KG | CADMIUM |
| 16 | MG/KG | COBALT |
| 37 | MG/KG | CHROMIUM |
| 34 | MG/KG | COPPER |
| 1.0 | MG/KG | MOLYBDENUM |
| 32 | MG/KG | NICKEL |
| 81 | MG/KG | LEAD |
| 0.23 | MG/KG | ANTIMONY |
| 1.7 | MG/KG | SELENIUM |
| 5.0U | MG/KG | TIN |
| 19 | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 70 | MG/KG | TITANIUM |
| 0.20U | MG/KG | THALLIUM |
| 33 | MG/KG | VANADIUM |
| 14 | MG/KG | YTTRIUM |
| 180 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.39 | MG/KG | TOTAL MERCURY |
| 19000 | MG/KG | ALUMINUM |
| 670 | MG/KG | MANGANESE |
| 3000 | MG/KG | CALCIUM |
| 1500 | MG/KG | MAGNESIUM |
| 25000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 1400 | MG/KG | POTASSIUM |
| 40 | % | % MOISTURE |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

C-confirmed by gcms 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

Sample 2381 FY 1998 Project 98-0241

Produced by: Mike Wasko

METALS SCAN

Requestor

Facility: Tennessee Products Chattanooga, TN

Project Leader AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station: S4

Ending:

Media: SOIL

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 7.9 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 110 | MG/KG | BARIUM |
| 1.0 | MG/KG | BERYLLIUM |
| 0.60 | MG/KG | CADMIUM |
| 18 | MG/KG | COBALT |
| 66 | MG/KG | CHROMIUM |
| 27 | MG/KG | COPPER |
| 1.0U | MG/KG | MOLYBDENUM |
| 36 | MG/KG | NICKEL |
| 66 | MG/KG | LEAD |
| 0.20U | MG/KG | ANTIMONY |
| 1.0U | MG/KG | SELENIUM |
| 5.0U | MG/KG | TIN |
| 16 | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 59 | MG/KG | TITANIUM |
| 0.20U | MG/KG | THALLIUM |
| 30 | MG/KG | VANADIUM |
| 12 | MG/KG | YTTRIUM |
| 170 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.26 | MG/KG | TOTAL MERCURY |
| 18000 | MG/KG | ALUMINUM |
| 1300 | MG/KG | MANGANESE |
| 2400 | MG/KG | CALCIUM |
| 1400 | MG/KG | MAGNESIUM |
| 21000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 1400 | MG/KG | POTASSIUM |
| 37 | % | % MOISTURE |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

<-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

>-confirmed by gcms 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

Sample 2382 FY 1998 Project 98-0241

METALS SCAN

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station S5

Media SOIL

Produced by: Mike Wasko

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 10 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 100 | MG/KG | BARIUM |
| 0.12 | MG/KG | BERYLLIUM |
| 0.52 | MG/KG | CADMIUM |
| 19 | MG/KG | COBALT |
| 59 | MG/KG | CHROMIUM |
| 23 | MG/KG | COPPER |
| 1.0U | MG/KG | MOLYBDENUM |
| 31 | MG/KG | NICKEL |
| 52 | MG/KG | LEAD |
| 0.20U | MG/KG | ANTIMONY |
| 1.4 | MG/KG | SELENIUM |
| 5.0U | MG/KG | TIN |
| 13 | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 84 | MG/KG | TITANIUM |
| 0.20U | MG/KG | THALLIUM |
| 34 | MG/KG | VANADIUM |
| 13 | MG/KG | YTTRIUM |
| 140 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.26 | MG/KG | TOTAL MERCURY |
| 20000 | MG/KG | ALUMINUM |
| 1000 | MG/KG | MANGANESE |
| 1500 | MG/KG | CALCIUM |
| 1500 | MG/KG | MAGNESIUM |
| 22000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 1500 | MG/KG | POTASSIUM |
| 36 | % | % MOISTURE |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

C-confirmed by gc/ms 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

Sample 2383 FY 1998 Project 98-0241

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: STA

Media: SOIL

Produced by: Mike Wasko

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 4.8 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 99 | MG/KG | BARIUM |
| 0.10 | MG/KG | BERYLLIUM |
| 0.56 | MG/KG | CADMIUM |
| 14 | MG/KG | COBALT |
| 36 | MG/KG | CHROMIUM |
| 17 | MG/KG | COPPER |
| 1.0U | MG/KG | MOLYBDENUM |
| 21 | MG/KG | NICKEL |
| 32 | MG/KG | LEAD |
| 0.20U | MG/KG | ANTIMONY |
| 1.0U | MG/KG | SELENIUM |
| 5.0U | MG/KG | TIN |
| 11 | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 84 | MG/KG | TITANIUM |
| 0.20U | MG/KG | THALLIUM |
| 28 | MG/KG | VANADIUM |
| 12 | MG/KG | YTTRIUM |
| 98 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.12 | MG/KG | TOTAL MERCURY |
| 18000 | MG/KG | ALUMINUM |
| 1100 | MG/KG | MANGANESE |
| 1700 | MG/KG | CALCIUM |
| 1400 | MG/KG | MAGNESIUM |
| 19000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 1300 | MG/KG | POTASSIUM |
| 23 | % | % MOISTURE |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

C-confirmed by gcms 1 when no value is reported see chlordane constituents 2 constituents or metabolites of technical chlordane

Sample 2384 FY 1998 Project 98-0241

Produced by: Mike Wasko

METALS SCAN

Requestor

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station: REFERENCE

Ending:

Media: SEDIM

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 7.4 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 66A | MG/KG | BARIUM |
| 0.75A | MG/KG | BERYLLIUM |
| 0.51A | MG/KG | CADMIUM |
| 12A | MG/KG | COBALT |
| 55 | MG/KG | CHROMIUM |
| 20A | MG/KG | COPPER |
| 1.0U | MG/KG | MOLYBDENUM |
| 22A | MG/KG | NICKEL |
| 53A | MG/KG | LEAD |
| 0.20U | MG/KG | ANTIMONY |
| 0.72 | MG/KG | SELENIUM |
| 5.0U | MG/KG | TIN |
| 15A | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 53A | MG/KG | TITANIUM |
| 0.20U | MG/KG | THALLIUM |
| 23 | MG/KG | VANADIUM |
| 7.7A | MG/KG | YTTRIUM |
| 140A | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.08 | MG/KG | TOTAL MERCURY |
| 9900A | MG/KG | ALUMINUM |
| 710A | MG/KG | MANGANESE |
| 3700 | MG/KG | CALCIUM |
| 1200A | MG/KG | MAGNESIUM |
| 18000 | MG/KG | BROMINE |
| 100U | MG/KG | SODIUM |
| 970A | MG/KG | POTASSIUM |
| 28 | % | % MOISTURE |

average value NA not analyzed NA1 interference U estimated value U1 presumptive evidence of presence of material

actual value is known to be less than value given U1 actual value is known to be greater than value given U1 material was analyzed for but not detected the number is the minimum quantitation limit

qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

confirmed by gc/ms 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

Sample 2384 FY 1998 Project 98-0241
METALS SCAN
 Facility: Tennessee Products Chattanooga, TN
 Program: SSF
 Id/Station: REFERENCE
 Media: SEDIM

Produced by: Mike Wasko
 Requestor
 Project Leader: AAUWARTE
 Beginning: 02/13/98
 Ending:

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 7.4 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 66A | MG/KG | BARIUM |
| 0.75A | MG/KG | BERYLLIUM |
| 0.51A | MG/KG | CADMIUM |
| 12A | MG/KG | COBALT |
| 55 | MG/KG | CHROMIUM |
| 20A | MG/KG | COPPER |
| 1.0U | MG/KG | MOLYBDENUM |
| 22A | MG/KG | NICKEL |
| 53A | MG/KG | LEAD |
| 0.20U | MG/KG | ANTIMONY |
| 0.72 | MG/KG | SELENIUM |
| 5.0U | MG/KG | TIN |
| 15A | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 53A | MG/KG | TITANIUM |
| 0.20U | MG/KG | THALLIUM |
| 23 | MG/KG | VANADIUM |
| 7.7A | MG/KG | YTTRIUM |
| 140A | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.08 | MG/KG | TOTAL MERCURY |
| 9900A | MG/KG | ALUMINUM |
| 710A | MG/KG | MANGANESE |
| 3700 | MG/KG | CALCIUM |
| 1200A | MG/KG | MAGNESIUM |
| 18000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 970A | MG/KG | POTASSIUM |
| 28 | % | % MOISTURE |

-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material

-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

-confirmed by gcms. 1 when no value is reported, see chlordane constituents. 2 constituents or metabolites of technical chlordane

Sample 2386 FY 1998 Project 98-0241

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station 12%

Media: SEDIM

Produced by: Mike Wasko

Requestor:

Project Leader: AAUWARTE

Beginning: 02/13/98

Ending:

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1 0U | MG/KG | SILVER |
| 9 8A | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 78 | MG/KG | BARIUM |
| 0 86 | MG/KG | BERYLLIUM |
| 0 72 | MG/KG | CADMIUM |
| 14 | MG/KG | COBALT |
| 81 | MG/KG | CHROMIUM |
| 29 | MG/KG | COPPER |
| 1 0U | MG/KG | MOLYBDENUM |
| 29 | MG/KG | NICKEL |
| 59 | MG/KG | LEAD |
| 0.48A | MG/KG | ANTIMONY |
| 0.79 | MG/KG | SELENIUM |
| 6 0U | MG/KG | TIN |
| 19A | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 49A | MG/KG | TITANIUM |
| 0 20U | MG/KG | THALLIUM |
| 25 | MG/KG | VANADIUM |
| 9 2 | MG/KG | YTTRIUM |
| 170 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.24 | MG/KG | TOTAL MERCURY |
| 12000 | MG/KG | ALUMINUM |
| 770 | MG/KG | MANGANESE |
| 3800 | MG/KG | CALCIUM |
| 1400 | MG/KG | MAGNESIUM |
| 20000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 1100 | MG/KG | POTASSIUM |
| 32 | % | % MOISTURE |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

C-confirmed by gcms: 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

Sample 2387 FY 1998 Project: 98-0241

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: 25%

Media: SEDIM

Produced by Mike Wasko

Requestor

Project Leader: AAUWARTE

Beginning 02/13/98

Ending:

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 8.8 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 87 | MG/KG | BARIUM |
| 0.90 | MG/KG | BERYLLIUM |
| 1.0 | MG/KG | CADMIUM |
| 16 | MG/KG | COBALT |
| 99 | MG/KG | CHROMIUM |
| 44A | MG/KG | COPPER |
| 1.0U | MG/KG | MOLYBDENUM |
| 38 | MG/KG | NICKEL |
| 62 | MG/KG | LEAD |
| 0.39A | MG/KG | ANTIMONY |
| 1.3 | MG/KG | SELENIUM |
| 6.0U | MG/KG | TIN |
| 19 | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 71A | MG/KG | TITANIUM |
| 0.21A | MG/KG | THALLIUM |
| 26 | MG/KG | VANADIUM |
| 9.9 | MG/KG | YTTRIUM |
| 180 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.48 | MG/KG | TOTAL MERCURY |
| 14000 | MG/KG | ALUMINUM |
| 730 | MG/KG | MANGANESE |
| 5200 | MG/KG | CALCIUM |
| 1400 | MG/KG | MAGNESIUM |
| 21000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 1200 | MG/KG | POTASSIUM |
| 33 | % | % MOISTURE |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

C-confirmed by gcms: 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

Sample 2388 FY 1998 Project: 98-0241

Produced by Mike Wasko

METALS SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 02/13/98

Id/Station: 50%

Ending:

Media: SEDIM

Information on detection limits shortly

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 1.0U | MG/KG | SILVER |
| 8.7 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 88 | MG/KG | BARIUM |
| 0.83 | MG/KG | BERYLLIUM |
| 1.2A | MG/KG | CADMIUM |
| 15 | MG/KG | COBALT |
| 100 | MG/KG | CHROMIUM |
| 46 | MG/KG | COPPER |
| 1.0U | MG/KG | MOLYBDENUM |
| 42 | MG/KG | NICKEL |
| 58 | MG/KG | LEAD |
| 0.70 | MG/KG | ANTIMONY |
| 1.5 | MG/KG | SELENIUM |
| 6.0U | MG/KG | TIN |
| 23 | MG/KG | STRONTIUM |
| 1.0U | MG/KG | TELLURIUM |
| 59A | MG/KG | TITANIUM |
| 0.22A | MG/KG | THALLIUM |
| 26 | MG/KG | VANADIUM |
| 10 | MG/KG | YTTRIUM |
| 180 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.81 | MG/KG | TOTAL MERCURY |
| 15000 | MG/KG | ALUMINUM |
| 630 | MG/KG | MANGANESE |
| 7800A | MG/KG | CALCIUM |
| 2500A | MG/KG | MAGNESIUM |
| 20000 | MG/KG | IRON |
| 100U | MG/KG | SODIUM |
| 1200 | MG/KG | POTASSIUM |
| 37 | % | % MOISTURE |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

C-confirmed by gcms 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

Production Date: 03/30/98 15:57

Produced by Sam Dutton

Requestor

Project Leader: AAUWARTE

Beginning 03/10/98 10 05

Ending

1.4 % LIPIDS

1.4

K-actual value is known to be less than value given, L-actual value is known to be greater than value given, U-material was analyzed for but not detected the number is the minimum quantitation limit

R-actual value is known to be less than value given. L-actual value is known to be greater than value given. S-actual value is equal to value given. R-nc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SED, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2882 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station CONTROL

Media WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 10 10

Ending

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 2.7 | | % LIPIDS |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material
K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit
R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2883 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station S-5-2

Media WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 10:15

Ending

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 5.2 | | % LIPIDS |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U material was analyzed for but not detected the number is the minimum quantitation limit

R qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

If indicated by R or RAI, a minimum of 10% is required for duplicate concentration. If indicated by R or RAI, the degree of the test is indicated.

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

| | | | | | | | |
|-----------------|--------------------|----|------|-----------------|---------|----------------|----------------|
| Sample | 2884 | FY | 1998 | Project | 98-0270 | Produced by | Sam Dutton |
| SPECIFIED TESTS | | | | | | Requestor | |
| Facility | Tennessee Products | | | Chattanooga, TN | | Project Leader | AAUWARTE |
| Program | SSF | | | | | Beginning | 03/10/98 11:45 |
| Id/Station | TA-1 | | | | | Ending | |
| Media | WORMS | | | | | | I |

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 2.7 | | % LIPIDS |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2885 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-1-2

Media: WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 11:50

Ending

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 7.2 | | % LIPIDS |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

B-gc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SED, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2886 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station S-2-2

Media WORMS

Produced by Sam Dutton

Requestor:

Project Leader AAUWARTE

Beginning 03/10/98 11 55

Ending

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 2.8 | | % LIPIDS |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

P-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

If information is not reported, the number is the number of times the compound was analyzed and the number of times it was detected

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2887 Fr 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station S-3-2

Media: WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 12 00

Ending

I

RESULTS UNITS ANALYTE

5.7

% LIPIDS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

M-quantified by GC/MS. L-when no value is reported, see minimum quantitation limit. U-when no value is reported, see minimum quantitation limit.

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2888 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station S-5-3

Media WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 13 00

Ending

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 23 | | % LIPIDS |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-nc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2889 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-2-3

Media: WORMS

Produced by: Sam Dutton

Requestor

Project Leader: AAUWARTE

Beginning 03/10/98 13:05

Ending

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------|
|---------|-------|---------|

5.0

% LIPIDS

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

R_{gc} indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2890 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station S-4-3

Media WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 13 10

Ending

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 17 | | % LIPIDS |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

P qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2891 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-3-3

Media: WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 13.15

Ending

I

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 5.4 | | % LIPIDS |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-nc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

K-continued by group L-continued by group N-continued by group R-continued by group U-continued by group

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SED, ATHENS, GA

Production Date: 03/30/98 15:57

| | | | | | | | |
|-----------------|--------------------|----|------|-----------------|---------|----------------|----------------|
| Sample | 2892 | FY | 1998 | Project | 98-0270 | Produced by | Sam Dutton |
| SPECIFIED TESTS | | | | | | Requestor | |
| Facility | Tennessee Products | | | Chattanooga, TN | | Project Leader | AAUWARTE |
| Program | SSF | | | | | Beginning | 03/10/98 13 40 |
| Id/Station | REF-2 | | | | | Ending | |
| Media | WORMS | | | | | | I |

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 1.7 | | % LIPIDS |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit
P or indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2893 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station REF-3

Media WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 13 45

Ending

I

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 1.6 | | % LIPIDS |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

Produced by State of Georgia Department of Environmental Protection, Athens, Georgia. Produced by Region IV, Athens, Georgia. Produced by Region IV, Athens, Georgia.

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2894 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program SSF

Id/Station TA-2

Media WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 13 50

Ending

RESULTS UNITS ANALYTE

7.6

% LIPIDS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

EPA/600/R-98/001a USEPA REGION IV, ATHENS, GA

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SED, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2895 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-1-3

Media: WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 13:55

Ending

| RESULTS | UNITS | ANALYTE |
|---------|-------|----------|
| 3.4 | | % LIPIDS |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification

Produced by the Atlanta Regional Council of Governments, Atlanta, Georgia. For more information, contact the Regional Council of Governments, 100 Peachtree Street, N.E., Atlanta, Georgia 30309. Phone: (404) 525-1000. Fax: (404) 525-1001.

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SESD, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2896 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility Tennessee Products Chattanooga, TN

Program: SSF

Id/Station REF-1

Media WORMS

Produced by Sam Dutton

Requestor:

Project Leader AAUWARTE

Beginning: 03/10/98 14 10

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------|
|---------|-------|---------|

3 1

% LIPIDS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

K-actual value is known to be less than value given. E-actual value is known to be greater than value given. S-material was analyzed. R- or indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

[illegible]

EXTRACTABLES SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 03/30/98 15:57

Sample 2897 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga TN

Program: SSF

Id/Station TA-3

Media: WORMS

Produced by Sam Dutton

Requestor

Project Leader AAUWARTE

Beginning 03/10/98 14:15

Ending:

1

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------|
|---------|-------|---------|

| 10.3 | % LIPIDS |
|------|----------|
|------|----------|

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material
K-actual value is known to be less than value given L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit

R-actual value is known to be less than value given t-actual value is known to be greater than value given 0 matches was analyzed
R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

R-qc indicates that data unusable. Compound may or may not be present. Resampling and reanalysis is necessary for confirmation.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

Science and Ecosystem Support Division
980 College Station Road
Athens, Georgia 30605-2720

June 12, 1998

Mark Sprenger
U.S. EPA, Environmental Response Branch
Woodbridge Ave.
Raritan Depot Bldg. 18
Edison, NJ 08837

Dear Mark:

Earlier this week I received the final data set for the Chattanooga Creek project, inorganic analytical results for earthworms, and a copy is enclosed. Also enclosed is the data for percent moisture for the worms. These two data sets conclude the analytical chemistry that we had projected for this project. Let me know if you have questions concerning any of the enclosed information or concerning that which was sent earlier. I hope report preparation is moving along well, and hopefully this is the last of the supporting materials you will need for it's completion.

It was nice to catch up with Nancy here at the last ETAG meeting, and I hope to see you here in Region 4 before too long.

Best Regards,

A handwritten signature in black ink, appearing to read "Alan", is positioned below the "Best Regards," text.

Alan Auwarter

xc: Lynn Wellman
xc with data: Nestor Young



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region 4

**Science and Ecosystem Support Division
980 College Station Road
Athens, Georgia 30605-2720**

MEMORANDUM

Date: 06/05/98

Subject: Results of METALS INORGANIC Sample Analysis
98-0270 Tennessee Products
Chattanooga, TN

From: Wasko, Mike *Mike Wasko*

To: Auwarter, Alan

CC: SESD/EAB/EES

Thru: Scifres, Jenny *Jenny Scifres*
Chief, INORGANIC

Attached are the results of analysis of samples collected as part of the subject project. If you have any questions, please contact me.

ATTACHMENT

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2876 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-5-1

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 09:15

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.48U | MG/KG | SILVER |
| 0.47 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 0.48U | MG/KG | BARIUM |
| 0.24U | MG/KG | BERYLLIUM |
| 8.9 | MG/KG | CADMIUM |
| 0.48U | MG/KG | COBALT |
| 0.48U | MG/KG | CHROMIUM |
| 12 | MG/KG | COPPER |
| 0.48U | MG/KG | MOLYBDENUM |
| 0.96U | MG/KG | NICKEL |
| 1.9U | MG/KG | LEAD |
| 1.9U | MG/KG | ANTIMONY |
| 0.96 | MG/KG | SELENIUM |
| 1.4U | MG/KG | TIN |
| 1.9 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 0.48U | MG/KG | TITANIUM |
| 4.8U | MG/KG | THALLIUM |
| 0.48U | MG/KG | VANADIUM |
| 0.48U | MG/KG | YTTRIUM |
| 44 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 13 | MG/KG | ALUMINUM |
| 2.8 | MG/KG | MANGANESE |
| 250 | MG/KG | CALCIUM |
| 390 | MG/KG | MAGNESIUM |
| 490 | MG/KG | IRON |
| 3100 | MG/KG | SODIUM |
| 4000 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

H-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1. when no value is reported, see chlordane constituents 2. constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2877 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-2-1

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 09:20

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.50U | MG/KG | SILVER |
| 0.33 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 3.0 | MG/KG | BARIUM |
| 0.24U | MG/KG | BERYLLIUM |
| 0.59 | MG/KG | CADMIUM |
| 1.4 | MG/KG | COBALT |
| 1.9 | MG/KG | CHROMIUM |
| 3.0 | MG/KG | COPPER |
| 0.50U | MG/KG | MOLYBDENUM |
| 2.1 | MG/KG | NICKEL |
| 2.0U | MG/KG | LEAD |
| 2.0U | MG/KG | ANTIMONY |
| 0.61 | MG/KG | SELENIUM |
| 1.5U | MG/KG | TIN |
| 1.8 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 3.4 | MG/KG | TITANIUM |
| 4.9U | MG/KG | THALLIUM |
| 0.60 | MG/KG | VANADIUM |
| 0.50U | MG/KG | YTTRIUM |
| 25 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 320 | MG/KG | ALUMINUM |
| 19 | MG/KG | MANGANESE |
| 780 | MG/KG | CALCIUM |
| 160 | MG/KG | MAGNESIUM |
| 410 | MG/KG | IRON |
| 900 | MG/KG | SODIUM |
| 1500 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1. when no value is reported, see chlordane constituents 2. constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2878 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-4-1

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 09:25

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.48U | MG/KG | SILVER |
| 0.35 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 2.5 | MG/KG | BARIUM |
| 0.24U | MG/KG | BERYLLIUM |
| 0.62 | MG/KG | CADMIUM |
| 1.1 | MG/KG | COBALT |
| 1.4 | MG/KG | CHROMIUM |
| 2.4 | MG/KG | COPPER |
| 0.48U | MG/KG | MOLYBDENUM |
| 1.8 | MG/KG | NICKEL |
| 1.9U | MG/KG | LEAD |
| 1.9U | MG/KG | ANTIMONY |
| 0.78 | MG/KG | SELENIUM |
| 1.4U | MG/KG | TIN |
| 1.6 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 3.1 | MG/KG | TITANIUM |
| 4.8U | MG/KG | THALLIUM |
| 0.50 | MG/KG | VANADIUM |
| 0.48U | MG/KG | YTTRIUM |
| 23 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 270 | MG/KG | ALUMINUM |
| 22 | MG/KG | MANGANESE |
| 630 | MG/KG | CALCIUM |
| 160 | MG/KG | MAGNESIUM |
| 380 | MG/KG | IRON |
| 780 | MG/KG | SODIUM |
| 1600 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1. when no value is reported, see chlordane constituents. 2. constituents or metabolites of technical chlordane.

METALS SAMPLE ANALYSIS

EPA - REGION IV SED, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2879 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-3-1

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 09:30

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.49U | MG/KG | SILVER |
| 1.0 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 2.8 | MG/KG | BARIUM |
| 0.24U | MG/KG | BERYLLIUM |
| 0.44 | MG/KG | CADMIUM |
| 0.83 | MG/KG | COBALT |
| 1.6 | MG/KG | CHROMIUM |
| 2.3 | MG/KG | COPPER |
| 0.49U | MG/KG | MOLYBDENUM |
| 1.5 | MG/KG | NICKEL |
| 1.9U | MG/KG | LEAD |
| 1.9U | MG/KG | ANTIMONY |
| 0.88 | MG/KG | SELENIUM |
| 1.4U | MG/KG | TIN |
| 1.7 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 3.1 | MG/KG | TITANIUM |
| 4.9U | MG/KG | THALLIUM |
| 0.55 | MG/KG | VANADIUM |
| 0.49U | MG/KG | YTTRIUM |
| 22 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 290 | MG/KG | ALUMINUM |
| 16 | MG/KG | MANGANESE |
| 650 | MG/KG | CALCIUM |
| 160 | MG/KG | MAGNESIUM |
| 390 | MG/KG | IRON |
| 700 | MG/KG | SODIUM |
| 1500 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2880 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-4-2

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 10:00

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.50U | MG/KG | SILVER |
| 0.32 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 1.7 | MG/KG | BARIUM |
| 0.25U | MG/KG | BERYLLIUM |
| 0.55 | MG/KG | CADMIUM |
| 0.82 | MG/KG | COBALT |
| 1.3 | MG/KG | CHROMIUM |
| 2.6 | MG/KG | COPPER |
| 0.50U | MG/KG | MOLYBDENUM |
| 1.4 | MG/KG | NICKEL |
| 2.0U | MG/KG | LEAD |
| 2.0U | MG/KG | ANTIMONY |
| 0.87 | MG/KG | SELENIUM |
| 1.5U | MG/KG | TIN |
| 1.4 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 2.0 | MG/KG | TITANIUM |
| 5.0U | MG/KG | THALLIUM |
| 0.50U | MG/KG | VANADIUM |
| 0.50U | MG/KG | YTTRIUM |
| 22 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 180 | MG/KG | ALUMINUM |
| 15 | MG/KG | MANGANESE |
| 590 | MG/KG | CALCIUM |
| 150 | MG/KG | MAGNESIUM |
| 240 | MG/KG | IRON |
| 840 | MG/KG | SODIUM |
| 1600 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1. when no value is reported, see chlordane constituents 2. constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2881 FY 1998 Project 98-0270
METALS SCAN
Facility: Tennessee Products Chattanooga, TN
Program: SSF
Id/Station: S-1-1
Media: WORMS

Produced by: Wasko, Mike
Requestor:
Project Leader: AAUWARTE
Beginning: 03/10/98 10:05
Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.48U | MG/KG | SILVER |
| 0.28 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 2.2 | MG/KG | BARIUM |
| 0.24U | MG/KG | BERYLLIUM |
| 0.51 | MG/KG | CADMIUM |
| 0.48U | MG/KG | COBALT |
| 1.1 | MG/KG | CHROMIUM |
| 2.3 | MG/KG | COPPER |
| 0.48U | MG/KG | MOLYBDENUM |
| 1.4 | MG/KG | NICKEL |
| 1.9U | MG/KG | LEAD |
| 1.9U | MG/KG | ANTIMONY |
| 0.72 | MG/KG | SELENIUM |
| 1.4U | MG/KG | TIN |
| 1.4 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 2.4 | MG/KG | TITANIUM |
| 4.8U | MG/KG | THALLIUM |
| 0.48U | MG/KG | VANADIUM |
| 0.48U | MG/KG | YTTRIUM |
| 20 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 230 | MG/KG | ALUMINUM |
| 30 | MG/KG | MANGANESE |
| 590 | MG/KG | CALCIUM |
| 140 | MG/KG | MAGNESIUM |
| 310 | MG/KG | IRON |
| 720 | MG/KG | SODIUM |
| 1300 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected the number is the minimum quantitation limit.

R-qc indicates that data unusable compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2882 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: CONTROL

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 10:10

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.73U | MG/KG | SILVER |
| 0.37U | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 1.4 | MG/KG | BARIUM |
| 0.36U | MG/KG | BERYLLIUM |
| 0.37 | MG/KG | CADMIUM |
| 0.73U | MG/KG | COBALT |
| 0.73U | MG/KG | CHROMIUM |
| 1.5 | MG/KG | COPPER |
| 0.73U | MG/KG | MOLYBDENUM |
| 1.5U | MG/KG | NICKEL |
| 2.9U | MG/KG | LEAD |
| 2.9U | MG/KG | ANTIMONY |
| 0.74 | MG/KG | SELENIUM |
| 2.2U | MG/KG | TIN |
| 1.2 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 6.8 | MG/KG | TITANIUM |
| 7.3U | MG/KG | THALLIUM |
| 0.73U | MG/KG | VANADIUM |
| 0.73U | MG/KG | YTTRIUM |
| 22 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 320 | MG/KG | ALUMINUM |
| 5.0 | MG/KG | MANGANESE |
| 510 | MG/KG | CALCIUM |
| 300 | MG/KG | MAGNESIUM |
| 170 | MG/KG | IRON |
| 800 | MG/KG | SODIUM |
| 1300 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2883 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-5-2

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 10:15

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.49U | MG/KG | SILVER |
| 0.38 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 2.2 | MG/KG | BARIUM |
| 0.25U | MG/KG | BERYLLIUM |
| 0.45 | MG/KG | CADMIUM |
| 1.2 | MG/KG | COBALT |
| 1.1 | MG/KG | CHROMIUM |
| 2.1 | MG/KG | COPPER |
| 0.49U | MG/KG | MOLYBDENUM |
| 1.3 | MG/KG | NICKEL |
| 2.0U | MG/KG | LEAD |
| 2.0U | MG/KG | ANTIMONY |
| 0.85 | MG/KG | SELENIUM |
| 1.5U | MG/KG | TIN |
| 1.4 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 2.2 | MG/KG | TITANIUM |
| 4.9U | MG/KG | THALLIUM |
| 0.49U | MG/KG | VANADIUM |
| 0.49U | MG/KG | YTTRIUM |
| 20 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 240 | MG/KG | ALUMINUM |
| 13 | MG/KG | MANGANESE |
| 580 | MG/KG | CALCIUM |
| 140 | MG/KG | MAGNESIUM |
| 310 | MG/KG | IRON |
| 660 | MG/KG | SODIUM |
| 1400 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2884 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: TA-1

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 11:45

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.43U | MG/KG | SILVER |
| 0.21 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 1.4 | MG/KG | BARIUM |
| 0.21U | MG/KG | BERYLLIUM |
| 0.75 | MG/KG | CADMIUM |
| 0.43U | MG/KG | COBALT |
| 0.63 | MG/KG | CHROMIUM |
| 3.1 | MG/KG | COPPER |
| 0.43U | MG/KG | MOLYBDENUM |
| 1.2 | MG/KG | NICKEL |
| 1.7U | MG/KG | LEAD |
| 1.7U | MG/KG | ANTIMONY |
| 0.67 | MG/KG | SELENIUM |
| 1.3U | MG/KG | TIN |
| 1.4 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 1.4 | MG/KG | TITANIUM |
| 4.3U | MG/KG | THALLIUM |
| 0.43U | MG/KG | VANADIUM |
| 0.43U | MG/KG | YTTRIUM |
| 21 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 130 | MG/KG | ALUMINUM |
| 13 | MG/KG | MANGANESE |
| 660 | MG/KG | CALCIUM |
| 140 | MG/KG | MAGNESIUM |
| 200 | MG/KG | IRON |
| 750 | MG/KG | SODIUM |
| 1500 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1. when no value is reported, see chlordane constituents. 2. constituents or metabolites of technical chlordane.

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2885 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products

Chattanooga, TN

Program: SSF

Id/Station: S-1-2

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 11:50

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.48U | MG/KG | SILVER |
| 0.24 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 1.6 | MG/KG | BARIUM |
| 0.24U | MG/KG | BERYLLIUM |
| 0.56 | MG/KG | CADMIUM |
| 0.48U | MG/KG | COBALT |
| 0.72 | MG/KG | CHROMIUM |
| 2.2 | MG/KG | COPPER |
| 0.48U | MG/KG | MOLYBDENUM |
| 1.3 | MG/KG | NICKEL |
| 1.9U | MG/KG | LEAD |
| 1.9U | MG/KG | ANTIMONY |
| 0.79 | MG/KG | SELENIUM |
| 1.4U | MG/KG | TIN |
| 1.6 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 1.7 | MG/KG | TITANIUM |
| 4.8U | MG/KG | THALLIUM |
| 0.48U | MG/KG | VANADIUM |
| 0.48U | MG/KG | YTTRIUM |
| 21 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 160 | MG/KG | ALUMINUM |
| 20 | MG/KG | MANGANESE |
| 680 | MG/KG | CALCIUM |
| 150 | MG/KG | MAGNESIUM |
| 230 | MG/KG | IRON |
| 830 | MG/KG | SODIUM |
| 1500 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2886 FY 1998 Project: 98-0270
METALS SCAN
Facility: Tennessee Products Chattanooga, TN
Program: SSF
Id/Station: S-2-2
Media: WORMS

Produced by: Wasko, Mike
Requestor:
Project Leader: AAUWARTE
Beginning: 03/10/98 11:55
Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.50U | MG/KG | SILVER |
| 0.26 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 2.3 | MG/KG | BARIUM |
| 0.25U | MG/KG | BERYLLIUM |
| 0.73 | MG/KG | CADMIUM |
| 0.50U | MG/KG | COBALT |
| 1.4 | MG/KG | CHROMIUM |
| 2.6 | MG/KG | COPPER |
| 0.50U | MG/KG | MOLYBDENUM |
| 1.6 | MG/KG | NICKEL |
| 2.0U | MG/KG | LEAD |
| 2.0U | MG/KG | ANTIMONY |
| 0.68 | MG/KG | SELENIUM |
| 1.5U | MG/KG | TIN |
| 1.4 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 3.2 | MG/KG | TITANIUM |
| 5.0U | MG/KG | THALLIUM |
| 0.50 | MG/KG | VANADIUM |
| 0.50U | MG/KG | YTTRIUM |
| 22 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 280 | MG/KG | ALUMINUM |
| 18 | MG/KG | MANGANESE |
| 640 | MG/KG | CALCIUM |
| 150 | MG/KG | MAGNESIUM |
| 350 | MG/KG | IRON |
| 740 | MG/KG | SODIUM |
| 1500 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2887 FY 1998 Project 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-3-2

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 12:00

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.48U | MG/KG | SILVER |
| 0.91 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 1.7 | MG/KG | BARIUM |
| 0.24U | MG/KG | BERYLLIUM |
| 0.43 | MG/KG | CADMIUM |
| 0.90 | MG/KG | COBALT |
| 0.90 | MG/KG | CHROMIUM |
| 2.2 | MG/KG | COPPER |
| 0.48U | MG/KG | MOLYBDENUM |
| 0.97U | MG/KG | NICKEL |
| 1.9U | MG/KG | LEAD |
| 1.9U | MG/KG | ANTIMONY |
| 0.92 | MG/KG | SELENIUM |
| 1.4U | MG/KG | TIN |
| 1.5 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 1.8 | MG/KG | TITANIUM |
| 4.8U | MG/KG | THALLIUM |
| 0.48U | MG/KG | VANADIUM |
| 0.48U | MG/KG | YTTRIUM |
| 22 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 160 | MG/KG | ALUMINUM |
| 8.9 | MG/KG | MANGANESE |
| 600 | MG/KG | CALCIUM |
| 140 | MG/KG | MAGNESIUM |
| 220 | MG/KG | IRON |
| 880 | MG/KG | SODIUM |
| 1600 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1. when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2888 FY 1998 Project 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-5-3

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 13:00

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.50U | MG/KG | SILVER |
| 0.28 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 1.5 | MG/KG | BARIUM |
| 0.25U | MG/KG | BERYLLIUM |
| 0.56 | MG/KG | CADMIUM |
| 0.89 | MG/KG | COBALT |
| 0.75 | MG/KG | CHROMIUM |
| 2.2 | MG/KG | COPPER |
| 0.50U | MG/KG | MOLYBDENUM |
| 1.0U | MG/KG | NICKEL |
| 2.0U | MG/KG | LEAD |
| 2.0U | MG/KG | ANTIMONY |
| 0.84 | MG/KG | SELENIUM |
| 1.5U | MG/KG | TIN |
| 1.5 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 1.3 | MG/KG | TITANIUM |
| 5.0U | MG/KG | THALLIUM |
| 0.50U | MG/KG | VANADIUM |
| 0.50U | MG/KG | YTTRIUM |
| 19 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 130 | MG/KG | ALUMINUM |
| 8.0 | MG/KG | MANGANESE |
| 680 | MG/KG | CALCIUM |
| 140 | MG/KG | MAGNESIUM |
| 180 | MG/KG | IRON |
| 730 | MG/KG | SODIUM |
| 1400 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1. when no value is reported, see chlordane constituents. 2. constituents or metabolites of technical chlordane.

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2889 FY 1998 Project 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-2-3

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 13:05

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.46U | MG/KG | SILVER |
| 0.29 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 2.9 | MG/KG | BARIUM |
| 0.23U | MG/KG | BERYLLIUM |
| 0.79 | MG/KG | CADMIUM |
| 0.60 | MG/KG | COBALT |
| 1.6 | MG/KG | CHROMIUM |
| 2.7 | MG/KG | COPPER |
| 0.46U | MG/KG | MOLYBDENUM |
| 2.0 | MG/KG | NICKEL |
| 1.8U | MG/KG | LEAD |
| 1.8U | MG/KG | ANTIMONY |
| 0.67 | MG/KG | SELENIUM |
| 1.4U | MG/KG | TIN |
| 1.5 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 3.4 | MG/KG | TITANIUM |
| 4.6U | MG/KG | THALLIUM |
| 0.61 | MG/KG | VANADIUM |
| 0.46U | MG/KG | YTTRIUM |
| 24 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.1U | MG/KG | TOTAL MERCURY |
| 330 | MG/KG | ALUMINUM |
| 31 | MG/KG | MANGANESE |
| 660 | MG/KG | CALCIUM |
| 160 | MG/KG | MAGNESIUM |
| 430 | MG/KG | IRON |
| 800 | MG/KG | SODIUM |
| 1500 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1. when no value is reported, see chlordane constituents 2. constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2890 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-4-3

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 13:10

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.48U | MG/KG | SILVER |
| 0.32 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 2.2 | MG/KG | BARIUM |
| 0.24U | MG/KG | BERYLLIUM |
| 0.73 | MG/KG | CADMIUM |
| 0.88 | MG/KG | COBALT |
| 1.3 | MG/KG | CHROMIUM |
| 2.3 | MG/KG | COPPER |
| 0.48U | MG/KG | MOLYBDENUM |
| 1.6 | MG/KG | NICKEL |
| 1.9U | MG/KG | LEAD |
| 1.9U | MG/KG | ANTIMONY |
| 0.79 | MG/KG | SELENIUM |
| 1.4U | MG/KG | TIN |
| 1.6 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 2.4 | MG/KG | TITANIUM |
| 4.8U | MG/KG | THALLIUM |
| 0.48U | MG/KG | VANADIUM |
| 0.48U | MG/KG | YTTRIUM |
| 22 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 230 | MG/KG | ALUMINUM |
| 20 | MG/KG | MANGANESE |
| 660 | MG/KG | CALCIUM |
| 150 | MG/KG | MAGNESIUM |
| 310 | MG/KG | IRON |
| 840 | MG/KG | SODIUM |
| 1500 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2891 FY 1998 Project: 98-0270

Produced by: Wasko, Mike

METALS SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 03/10/98 13:15

Id/Station: S-3-3

Ending:

Media: WORMS

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.49U | MG/KG | SILVER |
| 0.91 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 2.4 | MG/KG | BARIUM |
| 0.24U | MG/KG | BERYLLIUM |
| 0.46 | MG/KG | CADMIUM |
| 1.1 | MG/KG | COBALT |
| 1.3 | MG/KG | CHROMIUM |
| 2.3 | MG/KG | COPPER |
| 0.49U | MG/KG | MOLYBDENUM |
| 1.3 | MG/KG | NICKEL |
| 2.0U | MG/KG | LEAD |
| 2.0U | MG/KG | ANTIMONY |
| 0.88 | MG/KG | SELENIUM |
| 1.5U | MG/KG | TIN |
| 1.6 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 3.0 | MG/KG | TITANIUM |
| 4.9U | MG/KG | THALLIUM |
| 0.49 | MG/KG | VANADIUM |
| 0.49U | MG/KG | YTTRIUM |
| 22 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 260 | MG/KG | ALUMINUM |
| 14 | MG/KG | MANGANESE |
| 610 | MG/KG | CALCIUM |
| 150 | MG/KG | MAGNESIUM |
| 330 | MG/KG | IRON |
| 880 | MG/KG | SODIUM |
| 1500 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2892 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: REF-2

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 13:40

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.48U | MG/KG | SILVER |
| 0.28 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 2.3 | MG/KG | BARIUM |
| 0.24U | MG/KG | BERYLLIUM |
| 0.81 | MG/KG | CADMIUM |
| 0.58 | MG/KG | COBALT |
| 1.4 | MG/KG | CHROMIUM |
| 2.5 | MG/KG | COPPER |
| 0.48U | MG/KG | MOLYBDENUM |
| 2.0 | MG/KG | NICKEL |
| 1.9U | MG/KG | LEAD |
| 1.9U | MG/KG | ANTIMONY |
| 0.73 | MG/KG | SELENIUM |
| 1.4U | MG/KG | TIN |
| 1.6 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 3.2 | MG/KG | TITANIUM |
| 4.8U | MG/KG | THALLIUM |
| 0.52 | MG/KG | VANADIUM |
| 0.48U | MG/KG | YTTRIUM |
| 22 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 260 | MG/KG | ALUMINUM |
| 20 | MG/KG | MANGANESE |
| 650 | MG/KG | CALCIUM |
| 160 | MG/KG | MAGNESIUM |
| 380 | MG/KG | IRON |
| 760 | MG/KG | SODIUM |
| 1500 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2893 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: REF-3

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 13:45

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.50U | MG/KG | SILVER |
| 0.29 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 2.5 | MG/KG | BARIUM |
| 0.25U | MG/KG | BERYLLIUM |
| 0.77 | MG/KG | CADMIUM |
| 0.55 | MG/KG | COBALT |
| 1.3 | MG/KG | CHROMIUM |
| 2.2 | MG/KG | COPPER |
| 0.50U | MG/KG | MOLYBDENUM |
| 2.0 | MG/KG | NICKEL |
| 2.0U | MG/KG | LEAD |
| 2.0U | MG/KG | ANTIMONY |
| 0.77 | MG/KG | SELENIUM |
| 1.5U | MG/KG | TIN |
| 1.6 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 3.5 | MG/KG | TITANIUM |
| 5.0U | MG/KG | THALLIUM |
| 0.58 | MG/KG | VANADIUM |
| 0.50U | MG/KG | YTTRIUM |
| 22 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 300 | MG/KG | ALUMINUM |
| 20 | MG/KG | MANGANESE |
| 670 | MG/KG | CALCIUM |
| 150 | MG/KG | MAGNESIUM |
| 380 | MG/KG | IRON |
| 670 | MG/KG | SODIUM |
| 1400 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1. when no value is reported, see chlordane constituents 2. constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2894 FY 1998 Project: 98-0270

Produced by: Wasko, Mike

METALS SCAN

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 03/10/98 13:50

Id/Station: TA-2

Ending:

Media: WORMS

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.50U | MG/KG | SILVER |
| 0.24 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 1.4 | MG/KG | BARIUM |
| 0.24U | MG/KG | BERYLLIUM |
| 0.79 | MG/KG | CADMIUM |
| 0.50U | MG/KG | COBALT |
| 0.86 | MG/KG | CHROMIUM |
| 2.2 | MG/KG | COPPER |
| 0.50U | MG/KG | MOLYBDENUM |
| 1.2 | MG/KG | NICKEL |
| 1.9U | MG/KG | LEAD |
| 1.9U | MG/KG | ANTIMONY |
| 0.64 | MG/KG | SELENIUM |
| 1.4U | MG/KG | TIN |
| 1.3 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 1.3 | MG/KG | TITANIUM |
| 5.0U | MG/KG | THALLIUM |
| 0.50U | MG/KG | VANADIUM |
| 0.50U | MG/KG | YTTRIUM |
| 20 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 130 | MG/KG | ALUMINUM |
| 12 | MG/KG | MANGANESE |
| 650 | MG/KG | CALCIUM |
| 140 | MG/KG | MAGNESIUM |
| 200 | MG/KG | IRON |
| 770 | MG/KG | SODIUM |
| 1400 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2895 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-1-3

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 13:55

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.46U | MG/KG | SILVER |
| 0.25 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 2.3 | MG/KG | BARIUM |
| 0.23U | MG/KG | BERYLLIUM |
| 0.59 | MG/KG | CADMIUM |
| 0.46U | MG/KG | COBALT |
| 1.2 | MG/KG | CHROMIUM |
| 2.3 | MG/KG | COPPER |
| 0.46U | MG/KG | MOLYBDENUM |
| 1.6 | MG/KG | NICKEL |
| 1.8U | MG/KG | LEAD |
| 1.8U | MG/KG | ANTIMONY |
| 0.74 | MG/KG | SELENIUM |
| 1.4U | MG/KG | TIN |
| 1.5 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 3.0 | MG/KG | TITANIUM |
| 4.6U | MG/KG | THALLIUM |
| 0.49 | MG/KG | VANADIUM |
| 0.46U | MG/KG | YTTRIUM |
| 21 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 270 | MG/KG | ALUMINUM |
| 27 | MG/KG | MANGANESE |
| 610 | MG/KG | CALCIUM |
| 140 | MG/KG | MAGNESIUM |
| 350 | MG/KG | IRON |
| 720 | MG/KG | SODIUM |
| 1400 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1. when no value is reported, see chlordane constituents 2. constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2896 FY 1998 Project: 98-0270

Produced by: Wasko, Mike

METALS SCAN

Requestor:

Facility: Tennessee Products

Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 03/10/98 14:10

Id/Station: REF-1

Ending:

Media: WORMS

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.50U | MG/KG | SILVER |
| 0.26 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 2.3 | MG/KG | BARIUM |
| 0.25U | MG/KG | BERYLLIUM |
| 0.76 | MG/KG | CADMIUM |
| 0.54 | MG/KG | COBALT |
| 2.0 | MG/KG | CHROMIUM |
| 3.7 | MG/KG | COPPER |
| 0.50U | MG/KG | MOLYBDENUM |
| 1.8 | MG/KG | NICKEL |
| 2.0U | MG/KG | LEAD |
| 2.0U | MG/KG | ANTIMONY |
| 0.79 | MG/KG | SELENIUM |
| 1.5U | MG/KG | TIN |
| 1.5 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 2.5 | MG/KG | TITANIUM |
| 5.0U | MG/KG | THALLIUM |
| 0.50U | MG/KG | VANADIUM |
| 0.50U | MG/KG | YTTRIUM |
| 22 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 270 | MG/KG | ALUMINUM |
| 18 | MG/KG | MANGANESE |
| 630 | MG/KG | CALCIUM |
| 160 | MG/KG | MAGNESIUM |
| 370 | MG/KG | IRON |
| 700 | MG/KG | SODIUM |
| 1500 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms. 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SED, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2897 FY 1998 Project 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: TA-3

Media: WORMS

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 14:15

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.46U | MG/KG | SILVER |
| 0.22 | MG/KG | ARSENIC |
| NA | MG/KG | BORON |
| 1.6 | MG/KG | BARIUM |
| 0.23U | MG/KG | BERYLLIUM |
| 0.72 | MG/KG | CADMIUM |
| 0.46U | MG/KG | COBALT |
| 1.1 | MG/KG | CHROMIUM |
| 2.4 | MG/KG | COPPER |
| 0.46U | MG/KG | MOLYBDENUM |
| 1.1 | MG/KG | NICKEL |
| 1.8U | MG/KG | LEAD |
| 1.8U | MG/KG | ANTIMONY |
| 0.71 | MG/KG | SELENIUM |
| 1.4U | MG/KG | TIN |
| 1.4 | MG/KG | STRONTIUM |
| NA | MG/KG | TELLURIUM |
| 1.6 | MG/KG | TITANIUM |
| 4.6U | MG/KG | THALLIUM |
| 0.46U | MG/KG | VANADIUM |
| 0.46U | MG/KG | YTTRIUM |
| 20 | MG/KG | ZINC |
| NA | MG/KG | ZIRCONIUM |
| 0.10U | MG/KG | TOTAL MERCURY |
| 180 | MG/KG | ALUMINUM |
| 14 | MG/KG | MANGANESE |
| 670 | MG/KG | CALCIUM |
| 140 | MG/KG | MAGNESIUM |
| 240 | MG/KG | IRON |
| 740 | MG/KG | SODIUM |
| 1400 | MG/KG | POTASSIUM |

DATA REPORTED ON WET WEIGHT BASIS

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

A

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

e

r

-

S

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

C

Sample 2898 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: DIB-1

Media: DRY ICE BLANK

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 09:45

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.25U | UG/BO | SILVER |
| 0.75U | UG/BO | ARSENIC |
| NA | UG/BO | BORON |
| 0.25U | UG/BO | BARIUM |
| 0.12U | UG/BO | BERYLLIUM |
| 0.12U | UG/BO | CADMIUM |
| 0.25U | UG/BO | COBALT |
| 0.25U | UG/BO | CHROMIUM |
| 0.25U | UG/BO | COPPER |
| 0.25U | UG/BO | MOLYBDENUM |
| 0.50U | UG/BO | NICKEL |
| 1.1 | UG/BO | LEAD |
| 1.0U | UG/BO | ANTIMONY |
| 1.2U | UG/BO | SELENIUM |
| 1.5U | UG/BO | TIN |
| 0.25U | UG/BO | STRONTIUM |
| NA | UG/BO | TELLURIUM |
| 0.50U | UG/BO | TITANIUM |
| 2.5U | UG/BO | THALLIUM |
| 0.25U | UG/BO | VANADIUM |
| 0.25U | UG/BO | YTTRIUM |
| 0.45 | UG/BO | ZINC |
| NA | UG/BO | ZIRCONIUM |
| NA | UG/BO | TOTAL MERCURY |
| 5.0U | UG/BO | ALUMINUM |
| 0.25U | UG/BO | MANGANESE |
| 12U | UG/BO | CALCIUM |
| 2.5U | UG/BO | MAGNESIUM |
| 1.2U | UG/BO | IRON |
| 50U | UG/BO | SODIUM |
| 50U | UG/BO | POTASSIUM |

ar
to
un
w

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gc/ms: 1-when no value is reported, see chlordane constituents. 2-constituents or metabolites of technical chlordane.

METALS SAMPLE ANALYSIS**EPA - REGION IV SEDS, ATHENS, GA****Production Date: 06/05/98 11:09**

Sample 2900 FY 1998 Project: 98-0270

Produced by: Wasko, Mike

SPECIFIED TESTS

Requestor:

Facility: Tennessee Products Chattanooga, TN

Project Leader: AAUWARTE

Program: SSF

Beginning: 03/10/98 09:45

Id/Station: DIB-3

Ending:

Media: DRY ICE BLANK

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.01U | MG/KG | TOTAL MERCURY |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1. when no value is reported, see chlordane constituents. 2. constituents or metabolites of technical chlordane.

METALS SAMPLE ANALYSIS

EPA - REGION IV SESD, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2902 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: BB-2

Media: BLENDER BLANK

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 09:55

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 0.25U | UG/BO | SILVER |
| 0.75U | UG/BO | ARSENIC |
| NA | UG/BO | BORON |
| 0.25U | UG/BO | BARIUM |
| 0.12U | UG/BO | BERYLLIUM |
| 0.12U | UG/BO | CADMIUM |
| 0.25U | UG/BO | COBALT |
| 1.5 | UG/BO | CHROMIUM |
| 2.0 | UG/BO | COPPER |
| 0.25U | UG/BO | MOLYBDENUM |
| 0.84 | UG/BO | NICKEL |
| 1.0U | UG/BO | LEAD |
| 1.0U | UG/BO | ANTIMONY |
| 1.2U | UG/BO | SELENIUM |
| 1.5U | UG/BO | TIN |
| 0.25U | UG/BO | STRONTIUM |
| NA | UG/BO | TELLURIUM |
| 0.50U | UG/BO | TITANIUM |
| 2.5U | UG/BO | THALLIUM |
| 0.25U | UG/BO | VANADIUM |
| 0.25U | UG/BO | YTTRIUM |
| 2.2 | UG/BO | ZINC |
| NA | UG/BO | ZIRCONIUM |
| NA | UG/BO | TOTAL MERCURY |
| 5.0U | UG/BO | ALUMINUM |
| 0.25U | UG/BO | MANGANESE |
| 12U | UG/BO | CALCIUM |
| 2.5U | UG/BO | MAGNESIUM |
| 6.4 | UG/BO | IRON |
| 50U | UG/BO | SODIUM |
| 50U | UG/BO | POTASSIUM |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1 when no value is reported, see chlordane constituents 2 constituents or metabolites of technical chlordane

METALS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 06/05/98 11:09

Sample 2903 FY 1998 Project: 98-0270

METALS SCAN

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: ERB-1

Media: EQUIP RINSE BLANK

Produced by: Wasko, Mike

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 15:15

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|---------------|
| 2.5U | UG/L | SILVER |
| 7.5U | UG/L | ARSENIC |
| NA | UG/L | BORON |
| 2.5U | UG/L | BARIUM |
| 1.2U | UG/L | BERYLLIUM |
| 1.2U | UG/L | CADMIUM |
| 2.5U | UG/L | COBALT |
| 2.5U | UG/L | CHROMIUM |
| 2.5U | UG/L | COPPER |
| 2.5U | UG/L | MOLYBDENUM |
| 5.0U | UG/L | NICKEL |
| 10U | UG/L | LEAD |
| 10U | UG/L | ANTIMONY |
| 12U | UG/L | SELENIUM |
| 15U | UG/L | TIN |
| 2.5U | UG/L | STRONTIUM |
| NA | UG/L | TELLURIUM |
| 5.0U | UG/L | TITANIUM |
| 25U | UG/L | THALLIUM |
| 2.5U | UG/L | VANADIUM |
| 2.5U | UG/L | YTTRIUM |
| 6.4 | UG/L | ZINC |
| NA | UG/L | ZIRCONIUM |
| 0.20U | UG/L | TOTAL MERCURY |
| 50U | UG/L | ALUMINUM |
| 2.5U | UG/L | MANGANESE |
| 0.12U | MG/L | CALCIUM |
| 0.025U | MG/L | MAGNESIUM |
| 0.012U | MG/L | IRON |
| 0.50U | MG/L | SODIUM |
| 0.50U | MG/L | POTASSIUM |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1. when no value is reported, see chlordane constituents. 2. constituents or metabolites of technical chlordane.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region 4

**Science and Ecosystem Support Division
980 College Station Road
Athens, Georgia 30605-2720**

MEMORANDUM

Date: 05/05/98

Subject: Results of CLASSICALS/NUTRIENTS INORGANIC Sample Analysis
98-0270 Tennessee Products
Chattanooga, TN

% Moisture

From: White, Terri *Terri White*
To: Auwarter, Alan

CC: SESD/EAB/EES

Thru: Scifres, Jenny *Michael White for*
Chief, INORGANIC

Attached are the results of analysis of samples collected as part of the subject project. If you have any questions, please contact me.

ATTACHMENT

CLASSICALS/NUTRIENTS SAMPLE ANALYSIS

EPA - REGION IV SED, ATHENS, GA

Production Date: 05/05/98 08:48

Sample 2876 FY 1998 Project: 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-5-1

Media: WORMS

Produced by: White, Terri

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 09:15

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------|
| 84 | % | % MOISTURE |

A-average value NA-not analyzed NAI-interferences J-estimated value N-presumptive evidence of presence of material

K-actual value is known to be less than value given L-actual value is known to be greater than value given U-material was analyzed for but not detected the number is the minimum quantitation limit

R-qc indicates that data unusable compound may or may not be present resampling and reanalysis is necessary for verification

C-confirmed by gcms: 1 when no value is reported see chlordane constituents 2 constituents or metabolites of technical chlordane

CLASSICALS/NUTRIENTS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 05/05/98 08:48

Sample 2877 FY 1998 Project: 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-2-1

Media: WORMS

Produced by: White, Terri

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 09:20

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------|
| 87 | % | % MOISTURE |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirms the value of other values reported. see chlordane constituents. 2 constituents or metabolites of technical chlordane.

CLASSICALS/NUTRIENTS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 05/05/98 08:48

Sample 2878 FY 1998 Project: 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-4-1

Media: WORMS

Produced by: White, Terri

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 09:25

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------|
| 86 | % | % MOISTURE |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by some: 1 when no value is reported, see chlordane constituents. 2 constituents or metabolites of technical chlordane.

CLASSICALS/NUTRIENTS SAMPLE ANALYSIS

EPA - REGION IV SED, ATHENS, GA

Production Date: 05/05/98 08:48

Sample 2879 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-3-1

Media: WORMS

Produced by: White, Terri

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 09:30

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------|
| 82 | % | % MOISTURE |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1 when no value is reported. see chlordane constituents 2.constituents or metabolites of technical chlordane

CLASSICALS/NUTRIENTS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 05/05/98 08:48

Sample 2880 FY 1998 Project: 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-4-2

Media: WORMS

Produced by: White, Terri

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 10:00

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------|
| 84 | % | % MOISTURE |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1 when no value is reported. see chlordane constituents. 2 constituents or metabolites of technical chlordane.

CLASSICALS/NUTRIENTS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 05/05/98 08:48

Sample 2881 FY 1998 Project: 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-1-1

Media: WORMS

Produced by: White, Terri

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 10:05

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------|
| 84 | % | % MOISTURE |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-constituents of the 1,2-dichloroethane reported. 1,2-dichloroethane constituents. 2 constituents or metabolites of technical chloroethane.

CLASSICALS/NUTRIENTS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 05/05/98 08:48

Sample 2882 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: CONTROL

Media: WORMS

Produced by: White, Terri

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 10:10

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------|
| 81 | % | % MOISTURE |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

CLASSICALS/NUTRIENTS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 05/05/98 08:48

Sample 2883 FY 1998 Project: 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-5-2

Media: WORMS

Produced by: White, Terri

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 10:15

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------|
| 84 | % | % MOISTURE |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
1.0 - confirmed by gc/ms. 2.0 - no value is reported. 3.0 - 10.0 - constituents. 2.0 constituents or metabolites of technical chlordane.

CLASSICALS/NUTRIENTS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 05/05/98 08:48

Sample 2884 FY 1998 Project: 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: TA-1

Media: WORMS

Produced by: White, Terri

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 11:45

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------|
| 84 | % | % MOISTURE |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-actual value is reported. 1-actual value is reported. 2-constituents or metabolites of technical chlordane.

CLASSICALS/NUTRIENTS SAMPLE ANALYSIS

EPA - REGION IV SED, ATHENS, GA

Production Date: 05/05/98 08:48

Sample 2885 FY 1998 Project 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-1-2

Media: WORMS

Produced by: White, Terri

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 11:50

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------|
| 84 | % | % MOISTURE |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1 when no value is reported. see chlordane constituents. 2 constituents or metabolites of technical chlordane.

CLASSICALS/NUTRIENTS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 05/05/98 08:48

Sample 2886 FY 1998 Project: 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-2-2

Media: WORMS

Produced by: White, Terri

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 11:55

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------|
| 84 | % | % MOISTURE |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-nc indicates that data unusable compound may or may not be present. resampling and reanalysis is necessary for verification.

R-nc indicates that data unusable compound may or may not be present. resampling and reanalysis is necessary for verification.

CLASSICALS/NUTRIENTS SAMPLE ANALYSIS

EPA - REGION IV SEDS, ATHENS, GA

Production Date: 05/05/98 08:48

Sample 2887 FY 1998 Project: 98-0270

SPECIFIED TESTS

Facility: Tennessee Products Chattanooga, TN

Program: SSF

Id/Station: S-3-2

Media: WORMS

Produced by: White, Terri

Requestor:

Project Leader: AAUWARTE

Beginning: 03/10/98 12:00

Ending:

| RESULTS | UNITS | ANALYTE |
|---------|-------|------------|
| 83 | % | % MOISTURE |

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.

K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.

R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.

C-confirmed by gcms: 1 when no value is reported. see chlordane constituents. 2 constituents or metabolites of technical chlordane.

APPENDIX D

Hazard Characterization and Toxicity Profiles
Tennessee Products/Chattanooga Creek Superfund Site
Chattanooga, TN
February 1999

APPENDIX D

HAZARD CHARACTERIZATION AND TOXICITY PROFILES

D.1 Aluminum

Because of its strong reactivity, aluminum (Al) is not found as a free metal in nature. Aluminum has only one oxidation state (+3), thus its behavior in the environment depends on its ordination chemistry and the surrounding conditions. In soils, a low pH generally results in an increase in aluminum mobility. In water, an equilibrium with a solid phase is established that controls the extent of aluminum dissolution (ATSDR 1990a).

Plants vary in their ability to remove aluminum from soils, although bioconcentration factors for plants are generally less than one. Biomagnification of aluminum in terrestrial food chains does not appear to occur. There is no data on the biomagnification of aluminum in aquatic food chains (ATSDR 1990a).

The nervous system may be a target area for aluminum. Aluminum accumulates in neurofibrillary tangles in humans with Alzheimer's disease. Aluminum may also interact with neuronal deoxyribonucleic acid (DNA) to alter gene expression and protein formation. Mammalian studies do not indicate that aluminum affects reproduction although some developmental effects have been reported in mammals (ATSDR 1990a).

D.1.1 Aluminum Toxicity to Birds

No studies pertaining to the dietary toxicity of aluminum to the American robin were found. Therefore, literature pertaining to the dietary toxicity of aluminum to other bird species was reviewed. These other species will be used as surrogates to assess the dietary toxicity of aluminum to the American robin.

A 48-day feeding study conducted on chickens determined that dietary levels of 28.4 mg/kg BW/day of Al resulted in significantly depressed weight gain, food intake, and plasma inorganic phosphorus, and an increase in plasma calcium (Hussein 1990). The NOAEL in this study was reported to be 22.8 mg/kg BW/day. However, the ecological significance of altered plasma calcium and phosphorus was not discussed.

A 4-week dietary study using Japanese quail indicated that there were no observed effects when the quail were fed 0.05 percent Al (82.4 mg/kg BW/day) as aluminum sulfate (Hussein et al. 1988). At 0.1 percent (162.4 mg/kg BW/day) Al in the diet, a decrease in egg shell breaking strength was observed. At 0.15 percent (243.6 mg/kg BW/day) Al, decreases in body weight, egg shell strength, and egg shell production were observed.

In a separate study, leghorn chickens were exposed to aluminum (as aluminum sulfate) in the diet for a period of 17 weeks, and a significant decrease in egg production and feed intake were observed at a dosage of 171 mg/kg BW/day. At a dosage of 92.5 mg/kg BW/day, no effects on egg production or body weight were observed (Wisser et al. 1990).

Due to the significance of the endpoint and the longer duration of the study, the latter study was used to derive the NOAEL and LOAEL. A LOAEL of 171 mg/kg BW/day and a NOAEL of 92.5 mg/kg BW/day were used to evaluate the risk from aluminum to worm-eating birds.

D.1.2 Aluminum Toxicity to Mammals

No studies pertaining to the dietary toxicity of aluminum to the short-tailed shrew were found in the literature. Therefore, literature pertaining to the dietary toxicity of aluminum to the rat was reviewed. The rat was used as a surrogate to assess the dietary toxicity of aluminum to the short-tailed shrew.

In trials involving 170 male, weanling Sprague-Dawley rats, a concentration of 0.37 percent (1110 mg/kg BW/day) of aluminum in the diet as aluminum sulfate significantly decreased weight gain (Alsmeyer et al. 1963). When newborn rats were fed a diet containing 600 mg/kg (42.6 mg/kg BW/day) aluminum as aluminum chloride for approximately six months, no effects on growth, reproduction, or general appearance were noted (McCollum et al. 1928). Dixon et al. (1979) exposed rats to aluminum in drinking water 90 days prior to breeding. The highest dose (500 mg/liter [L] or 77.5 mg/kg BW/day) did not result in any reproductive abnormalities. In a different study, Lal et al. (1993) exposed rats to 55 mg/kg BW/day of aluminum in drinking water for 180 days. Behavioral effects were observed at this dose, including a significant reduction in spontaneous locomotor activity and significant deficits in acquisition and retention of learned responses.

For this study, a LOAEL of 55 mg/kg BW/day was used to estimate risk of aluminum to worm-eating mammals. A NOAEL of 5.5 mg/kg BW/day was derived from this LOAEL using an accepted conversion factor of 10.

D.2 Chromium

Chromium (Cr) can exist in oxidation states but is most frequently converted to the relatively stable trivalent and hexavalent states (Eisler 1986). In both freshwater and marine systems, hydrolysis and precipitation are the most important processes that determine the fate and effects of chromium, whereas adsorption and bioaccumulation are relatively minor. Precipitated trivalent chromium hydroxides remain in sediment under aerobic conditions. However, under anoxic and low pH conditions, trivalent chromium hydroxides may solubilize and remain in the ionic form unless oxidized to hexavalent chromium through mixing and aeration (Ecological Analysts, Inc. 1981). In soils, the solubility and bioavailability of chromium are governed by pH and organic complexing substances, although organic complexes play a more significant role (James and Bartlett 1983a and 1983b). The trivalent state is the form usually found in biological materials and functions as an essential element in mammals by maintaining efficient glucose, lipid, and protein metabolism (Eisler 1986). Chromium is beneficial but not essential to higher plants (Eisler 1986). The biomagnification and toxicity of trivalent chromium are low relative to hexavalent chromium because of its low membrane permeability and noncorrosivity. However, a large degree of accumulation by aquatic and terrestrial plants and animals in the lower trophic levels has been documented; the mechanism of this accumulation remains unknown.

Chromium is mutagenic, carcinogenic, and teratogenic, with hexavalent chromium exhibiting the greatest toxicity; relatively less is known about the toxicity of trivalent chromium (Eisler 1986). At high concentrations, hexavalent chromium is associated with abnormal enzyme activity, altered blood chemistry, lowered resistance to pathogenic organisms, behavioral modifications, disrupted feeding, histopathology, osmoregulatory problems, alterations in population structure, and inhibition of photosynthesis.

Rabbits fed chromium as part of their diet accumulated hyaluronates, chondroitin sulfates, and neutral mucopolysaccharides in the soft tissues, causing pericapillary sclerosis (Kucher et al. 1967). This accumulation blocked blood tissue barriers, which are permeable under normal conditions, preventing the normal transport of metabolites. One manifestation of this condition was the inhibition of insulin production in the pancreatic islets due to damage to the beta-cells contained therein. Exposure to

chromium may lead to nephron (kidney) damage via swelling and loss of microvilli, the formation of intracellular vacuoles, mitochondrial swelling, cytoplasmic liquification, and loss of cells lining the nephron surface (Evan and Dail 1974).

It is speculated that the preliminary step in chromium-induced respiratory cancer is scarring of alveolar tissue, followed by elicitation of inflammatory reactions in lung tissue leading to bronchopneumonia, alveolar epithelial changes, atrophy, and benign tumor formation. Direct skin contact with highly corrosive chromic acid and its anhydride produces skin ulcers and necrosis by a mechanism independent of any allergic response (Steven et al. 1976).

D.2.1 Chromium Toxicity to Birds

Romoser et al. (1961) reported no adverse effects on survival, growth, or food utilization in domestic broiler strain chicks fed diets containing up to 100 mg/kg of hexavalent chromium from 11 to 32 days of age. Hill and Matrone (1970) exposed 3-week old chicks to 95.2 mg/kg BW/day of chromium and observed no effects on body weight or mortality. Heinz and Haseltine (1981) exposed two to three year old breeding pairs of black ducks (*Anas rubripes*) to a diet containing 0, 20, or 200 mg/kg, wet weight, (0, 2.77, or 27.77 mg/kg BW/day) of trivalent chromium as chromium potassium sulfate for a period of approximately five months (until the onset of egg-laying by the females). Hatched ducklings were then fed a mash diet containing the same concentrations. Seven-day old chicks were tested for avoidance behavior in response to a fright stimulus; none of the chromium concentrations resulted in alteration of avoidance behavior. Haseltine et al. (1985), in an unpublished study reported by Eisler (1986), notes that black duck ducklings suffered adverse effects for reproduction, survival, and growth patterns when exposed to 10 mg/kg (1 mg/kg BW/day) and 50 mg/kg of an unspecified trivalent chromium compound in their diets.

For this study, a dietary exposure level of 10 mg/kg BW/day was used as a LOAEL and a dietary exposure level of 1 mg/kg BW/day was used as a NOAEL to estimate risk of chromium to worm-eating birds.

D.3 Lead

Lead (Pb) does not biomagnify to a great extent in food chains, although accumulation by plants and animals has been extensively documented (Wixson and Davis 1993; Eisler 1988). Older organisms typically contain the highest tissue lead concentrations, with the majority of the accumulation occurring in the bony tissue of vertebrates (Eisler 1988).

Predicting the accumulation and toxicity of lead is difficult since its effects are influenced to a very large degree, relative to other metals, by interactions among physical, chemical, and biological variables. In general, organolead compounds are more toxic than inorganic lead compounds, and young, immature organisms are most susceptible to its effects (Eisler 1988). In plants, lead inhibits growth by reducing photosynthetic activity, mitosis, and water absorption. The mechanism by which photosynthetic activity is reduced is attributed to the blocking of sulfhydryl groups, inhibiting the conversion of coproporphyrinogen to protoporphyrinogen (Holl and Hampp 1975).

The toxic effects of lead on aquatic and terrestrial organisms are extremely varied and include mortality, reduced growth and reproductive output, blood chemistry alterations, lesions, and behavioral changes. However, many effects exhibit general trends in their toxic mechanism. Generally, lead inhibits the formation of heme, adversely affects blood chemistry, and accumulates at hematopoietic organs (Eisler

1988). At high concentrations near levels causing mortality, marked changes to the central nervous system occur prior to death (Eisler 1988).

Plants can uptake lead through surface deposition in rain, dust, and soil, or by uptake through the roots. The ability of a plant to uptake lead from soils is inversely related to soil pH and organic matter content. Lead can inhibit photosynthesis, plant growth, and water absorption.

D.3.1 Lead Toxicity to Birds

No studies pertaining to the dietary toxicity of lead to the American robin were found in the literature. Therefore, literature pertaining to the dietary toxicity of lead to other bird species was reviewed and used to assess the chronic dietary toxicity of lead to the American robin.

One study on the effects of lead to the red-winged blackbird was found, in which a lethal dosage of lead acetate was administered in the diet to the birds. It was found that blood protoporphyrin decreased, delta aminolevulinic acid dehydratase (ALAD) increased, and renal intranuclear inclusion bodies were present prior to death (Beyer et al. 1988). However, due to the high lethal dosage and the experimental design (4.2 mg/kg BW/day, increased by 60 percent each week until 50 percent of the birds were dead), this study was not used to derive a LOAEL.

The gastric motility of adult male and female red-tailed hawks fed 0.82 and 1.64 mg Pb/kg BW/day in a single oral dose was evaluated through the use of surgically implanted transducers for a period of three weeks following the dose. Neither concentration had any effect on gastric contractions or egestion of undigested material pellets (Lawler et al. 1991).

A chronic study using Japanese quail resulted in no anemia and no depressed growth from exposure to 26 mg/kg BW/day of lead in the diet (Morgan et al. 1975). A study conducted on red-tailed hawks found that 3 mg/kg BW/day of lead caused the clinical symptoms of lead poisoning (Reiser and Temple 1981). A similar study found that 3 mg/kg BW/day fed to starlings caused a reduction in muscle condition and altered their feeding activity (Osborn et al. 1983). Adult male and female red-tailed hawks given an oral dose of 0.82 mg/kg BW/day each day for three weeks resulted in an 83 percent decrease in delta-aminolevulinic acid dehydratase activity and a 74 percent increase in the levels of free porphyrins circulating in the blood (Redig et al. 1991). Edens et al. (1976) exposed Japanese quail to 4 oral dose levels of lead acetate for a period of 12 weeks. The study identified a NOAEL of 0.133 mg/kg BW/day for egg production and a LOAEL of 1.33 mg/kg BW/day for hatching success.

The results of the latter study will be used to develop the NOAEL and LOAEL values based on the ecological significance of the endpoints and the method and duration of exposure. A LOAEL of 1.33 mg/kg BW/day and a NOAEL of 0.133 mg/kg BW/day were used to evaluate the risk posed by lead to worm-eating birds.

D.3.2 Lead Toxicity to Mammals

No dietary toxicity studies on lead using the short-tailed shrew were found in the literature. Therefore, literature pertaining to the dietary toxicity of lead to other mammals was reviewed and used to assess the chronic dietary toxicity of lead to the short-tailed shrew.

Mason and MacDonald (1986) evaluated the effect of lead and cadmium on otter (*Lutra lutra*). Daily lead intake was estimated on the basis of measured fecal lead levels, the known ingestion rate for otter, and gastrointestinal lead absorption rates for mammals. Estimated lead intake

correlated well with levels measured in major fish prey species. No apparent impact on population levels was found when lead intake was less than 0.15 mg/kg BW/day whereas otter populations were reduced in areas where the estimated lead intake exceeded 2 mg/kg BW/day. Adult pregnant mice (C57Bl strain) were fed a diet containing lead concentrations of 0.125, 0.25, 0.5, and 1 percent for 48 hours after mating (Jacquet et al. 1976). Dietary lead concentrations of 0.125 percent (16 mg/kg BW/day), 0.25 percent (32 mg/kg BW/day), and 0.5 percent (64 mg/kg BW/day) resulted in an increase in the number of embryos in the 4-cell stage versus the 8-cell stage. A delayed effect of increased non-divided embryos resulted from a dietary lead concentration of 1 percent (128 mg/kg BW/day). Luster et al. (1978) found that a chronic dose of 4.6 mg/kg/day resulted in no depressed immunity in rats. Azar et al. (1973) administered lead to rats in 5 dietary levels for three generations and measured changes in reproduction and growth. A dosage of 80 mg/kg BW/day reduced offspring weights and produced kidney damage in the young, while a dosage of 8 mg/kg BW/day did not result in adverse effects.

For this study, the latter study was used to select NOAEL and LOAEL values because of the ecological significance of the endpoints, the range of dose levels selected, and the duration of the study. A dietary exposure level of 8 mg/kg BW/day was used as a NOAEL and 80 mg/kg BW/day was used as a LOAEL to evaluate the risk posed by lead to worm-eating mammals.

D.4 Manganese

Manganese (Mn) does not occur as a free metal in the environment but is a component of numerous minerals. Elemental manganese and inorganic manganese compounds have negligible vapor pressures, but may exist in air as suspended particulate matter derived from industrial emissions or the erosion of soil. Removal from the atmosphere is mostly through gravitational settling. The transport and partitioning of manganese in water is controlled by the solubility of the specific chemical form present. The metal may exist in water in any of four oxidation states (2+, 3+, 4+, or 7+). Divalent manganese (Mn²⁺) predominates in most waters (pH 4 to 7), but may become oxidized at a pH greater than 8 or 9. Manganese is often transported in moving water as suspended sediments. The tendency of soluble manganese compounds to adsorb to soils and sediments depends mainly on the cation exchange capacity and the organic composition of the soil. Manganese in water may be significantly bioconcentrated at lower trophic levels. However, biomagnification in the food chain is not significant (ATSDR 1990b).

The amount of manganese absorbed across the gastrointestinal tract is variable. There does not appear to be a marked difference between manganese ingested in food or in water. One of the key determinants of absorption appears to be dietary iron intake, with low iron levels leading to increased manganese absorption. This is probably because both iron and manganese are absorbed by the same transport system in the gut (ATSDR 1990b).

D.4.1 Manganese Toxicity to Birds

No studies pertaining to the dietary toxicity of manganese to the American robin were found in the literature. Therefore, literature pertaining to the dietary toxicity of manganese to other birds was reviewed and used to evaluate the dietary toxicity of manganese to the American robin.

In one study, Southern and Baker (1983a) exposed chicks to manganese in their food over a period of 15 days and found that levels of 3168 ppm Mn (3000 ppm Mn as manganese sulfate plus 168 ppm in basal diet) resulted in depressed weight gain, with a corresponding NOAEL of 1688 ppm (1500 ppm plus 168 ppm in basal diet). The corresponding dosages for these dietary levels are a LOAEL of 370 mg/kg BW/day and a NOAEL of 200 mg/kg BW/day. Efficiency of feed utilization was not affected by any levels of manganese exposure. In a second study, Southern and Baker (1983b) conducted a second study in which chicks were exposed to levels of 3000 to

5000 ppm Mn as various manganese salts in their diet for 14 days. At all concentrations, manganese resulted in slight depression of growth and mild anemia. None of the manganese levels affected efficiency of feed utilization. The lowest dietary concentration (3000 ppm) corresponded to a dose of 380 mg/kg BW/day. In both studies, a depressed weight gain without a corresponding decrease in efficiency of feed utilization indicates the possibility that the decreased growth may be due to a decrease in food intake rather than a direct toxic effect of manganese.

Vohra and Kratzer (1968) conducted a study on turkey poults in which they were exposed to varying levels of manganese sulfate in their diet for a period of 21 days. A dietary concentration of 4800 ppm Mn (440 mg/kg BW/day) resulted in a depression of growth, with a corresponding NOAEL of 4080 ppm Mn (370 mg/kg BW/day).

Heller and Penquite (1937) studied the effects of various diets to chicks. They noted that exposure of chicks to dietary levels of 1% manganese carbonate (4779 ppm Mn) resulted in 52% mortality. This corresponds to a dose of 450 mg/kg BW/day. The authors do not provide details in their paper on experimental methodology or length of exposure.

Leeson and Summer (1982) exposed broiler chicks to manganous oxide in the diet for 21 days. No significant effects were observed in their performance at the highest dose of 880 mg/kg Mn (109 mg/kg BW/day).

Laskey and Edens (1985) studied the effects of manganese on Japanese quail. They exposed young Japanese quail to 5000 ppm Mn (776 mg/kg BW/day) as manganese oxide in their diet for 75 to 80 days. This concentration of manganese in the diet resulted in behavioral changes. Postpubertal locomotor activity failed to increase significantly as in the controls. Aggressive behavior remained 25-50% lower than in the control. Also, the exposed birds had a depressed level of serum testosterone concentrations (24% lower than the control), which is a measure of the development of the male reproductive system. This effect, however, was not statistically significant when compared to controls of the same age. The authors conclude that the reproductive effects were minimal, but that manganese does interfere with the reproductive axis by causing a reduction in the synthesis of testosterone concentrations, with concurrent effects on behavior.

Edens and Laskey (1990) exposed Japanese quail to 5000 ppm Mn (714 mg/kg BW/day) as manganese oxide in the diet for 10 weeks. Their results indicate that there were slight changes in blood chemistry, but that taken as a whole, the serum chemistries indicate that there were no harmful physiological effects from manganese exposure. Thus, in this study, 5000 ppm represents the NOAEL.

Based on a review of these studies, the Southern and Baker (1983a) study was used to derive the NOAEL and LOAEL for manganese toxicity to birds because it resulted in the lowest LOAEL of all the studies described above. However, there may be some uncertainty associated with using this study to derive the NOAEL and LOAEL. This is because the efficiency of feed utilization was not affected by the manganese concentrations, indicating that the decreased growth may be due to a decrease in food intake rather than a toxic effect. However, the NOAEL and LOAEL derived from this study were similar to some of the NOAELs and LOAELs derived from the other studies which resulted in other effects (mild anemia). Therefore, the Southern and Baker (1983a) LOAEL and NOAEL were selected because they were the most conservative numbers available from the literature.

D.4.2 Manganese Toxicity to Mammals

No studies pertaining to the dietary toxicity of manganese to the short-tailed shrew were found in the literature. Therefore, literature pertaining to the dietary toxicity of manganese to other mammals was reviewed and used to assess the dietary toxicity of manganese to the short-tailed shrew.

The effects levels for manganese toxicity vary widely, most likely attributable to the form of manganese tested. A reproductive study was conducted by Laskey et al. (1982) in which rats were exposed to three concentrations of manganese oxide in the diet from day 1 of gestation through 224 days of age. The most significant finding in this study was an observed reduction in fertility in the group receiving 3500 ppm Mn (178 mg/kg BW/day). At this dietary concentration the percentage of females that were pregnant were reduced. The corresponding NOAEL for this effect is 1050 ppm Mn (55 mg/kg BW/day). Although there was an observed decrease in testosterone levels in male rats at the 1050 ppm Mn level, the authors note that the effects were not severe enough to alter functional reproduction. In another study, chronic administration of manganese to mice via the diet altered behavior and reproductive development. (Gray and Laskey 1980). Mice were exposed to 1050 ppm Mn (140 mg/kg BW/day) as manganese oxide in the diet for 75 days. Exposure to Mn retarded the growth of the testes and sex accessory glands. The activity levels of Mn-treated males were also significantly reduced at 73 days of age. The mice were exposed to only one concentration, and thus there is no associated NOAEL. In another study, Komura and Sakatmoto (1992) observed a decrease in motor activity and body weights of mice exposed to a concentration of 2130 mg/kg Mn (210 mg/kg BW/day) in the diet over a one-year exposure period.

A much higher exposure concentration of 2,300 mg/kg BW/day of manganese as $MnCl_2$ resulted in reduced dopamine levels (Gianutsos and Murray 1982). In contrast, levels as high as 930 mg/kg BW/day of manganese as $MnSO_4$ for 103 weeks had no effect on the respiratory, cardiovascular, gastrointestinal, hematological, musculoskeletal, hepatic, renal, dermal, and ocular systems of mice (Hejtmancik et al. 1987).

The Laskey et al. (1982) study was used to derive the NOAEL and LOAEL for the evaluation of risk to worm-eating mammals from manganese. This study was selected due to the ecological relevance of the endpoint (reduced fertility) and the fact that it tested three doses. The Gray and Laskey (1980) study, which resulted in a slightly lower LOAEL, but it tested only one dose and it did not identify whether the effects observed affected functional reproduction. Therefore, a LOAEL of 178 mg/kg BW/day and a NOAEL of 55 mg/kg BW/day were selected to evaluate the risk from manganese to worm-eating mammals.

D.5 Mercury

Mercury (Hg) may be present in the environment in a number of forms. In all inorganic forms, Hg^{2+} is the toxic species. The most toxic and bioavailable form of mercury is methylmercury (MeHg), which is highly stable and lipophilic, accumulating in food chains. Mercury can become methylated biologically or chemically. Microbial methylation of mercury occurs most rapidly under anaerobic conditions, common in wetlands and aquatic sediments. The majority of mercury detected in biological tissues is present in the form of methylmercury (Huckabee et al. 1979).

Mercury has no known biological function, and its presence in biological systems appears to result in undesirable effects. A number of toxic responses have been reported for mercury exposure. Eisler (1987) reports that juvenile life stages are most susceptible to acute effects of mercury exposure. In fish, acute exposure results in impaired respiration, sluggishness, and loss of equilibrium (Armstrong 1979).

Mercury is a potent neurotoxin, resulting in impaired muscular coordination, weight loss, and apathy in birds, mammals, and fish (Eisler 1987). Other reported effects include histopathological changes, changes in enzyme activity levels, mutagenicity, teratogenicity, and reproductive impairment. Mercury, especially methylmercury, is known to concentrate in biological tissues and magnify through the food chain. Mercury can exist in three oxidation states: elemental mercury (Hg^0), mercurous ion (Hg_2^{2+}), and mercuric ion (Hg^{2+}). The mercuric ion is the most toxic inorganic chemical form (Clarkson and Marsh 1982). Methylmercury is the most hazardous form of mercury due to its high stability, lipid solubility, and ability to penetrate membranes in living organisms (Beijer and Jernelov 1979).

Mercury and its compounds have no known biological function. It is a mutagen, teratogen, and carcinogen, and causes embryocidal, cytochemical, and histopathological effects. Forms of mercury with relatively low toxicity can be transformed into forms of very high toxicity, such as methylmercury, through biological processes. In addition, mercury can be bioconcentrated in organisms and biomagnified through food chains.

Mercury in soils is generally not available for uptake by plants, due to the high binding capacity to clays and other charged particles (Beauford et al. 1977). Mercury levels in plant tissues increase as soil levels increase, however 95 percent of the accumulation and retention of mercury is in the root system (Beauford et al. 1977; Cocking et al. 1991).

All mercury compounds interfere with thiol metabolism in organisms, causing inhibition or inactivation of proteins containing thiol ligands and ultimately leading to mitotic disturbances (Das et al. 1982; Elhassani 1983). Mercury also binds strongly with sulfhydryl groups. Phenyl- and methylmercury compounds are among the strongest known inhibitors of cell division (Birge et al. 1979). In mammals, methylmercury irreversibly destroys the neurons of the central nervous system.

For all organisms tested, early developmental stages were most sensitive to toxic effects of mercury. Organomercury compounds, especially methylmercury, were more toxic than inorganic forms. In aquatic organisms, mercury adversely affects reproduction, growth, behavior, osmoregulation and oxygen exchange. At comparatively low concentrations in birds and mammals, mercury adversely affects growth and development, behavior, motor coordination, vision, hearing, histology, and metabolism. In mammals, the fetus is the most sensitive life stage (Eisler 1987).

D.5.1 Mercury Toxicity to Birds

No studies pertaining to the dietary toxicity of mercury to the American robin were found. Therefore, literature pertaining to the dietary toxicity of mercury to other bird species was reviewed and used to assess the dietary toxicity of mercury to the American robin.

Starlings fed 0.1 mg/kg BW/day of Hg for eight weeks were observed to have kidney lesions (Nicholson and Osborn 1984). Zebra finches fed a diet containing 1.75 mg Hg/kg BW/day suffered from neurological impairment and death while finches exposed to 0.88 mg Hg/kg BW/day had no signs of mercury poisoning (Scheuhammer 1988). Red-tailed hawks fed a diet containing 1.12 mg Hg/kg BW/day suffered from mortality, dilatation of myelin sheaths and loss of myelin. Hill and Schaffner (1976) exposed Japanese quail to five dose levels of mercuric chloride for a period of one year and identified a NOAEL of 0.60 mg/kg BW/day for egg production, fertility and hatching. Goshawks exposed to doses ranging from 0.7 to 1.2 mg/kg BW/day suffered complete mortality after between 30 and 47 days of exposure (Borg et al. 1970). For this study, the latter study was used to estimate risk of mercury to worm-eating birds. A dietary level of 0.7 mg/kg BW/day was used as a LOAEL. A NOAEL of 0.07 mg/kg BW/day was derived from this LOAEL using an accepted conversion factor of 10.

D.6 Nickel

Pure nickel (Ni) is a hard, white metal that is usually used in the formation of alloys (such as stainless steel), and nickel combined with other elements is found in all soils. Nickel is the twenty-fourth most abundant element and is found in the environment as oxides or sulfides. It may be released into the environment through mining, oil-burning power plants, coal-burning power plants, and incinerators. Nickel attaches to soil or sediment particles, especially those containing iron or manganese. Under acidic conditions, nickel may become more mobile and seep into the groundwater. The typical nickel concentration reported in soils is from 4 to 80 milligrams per kilogram (mg/kg). The speciation and physicochemical state of nickel are important in considering its behavior in the environment and its availability to biota (ATSDR 1996).

The most probable exposure routes of nickel is through dermal contact, inhalation of dust, and ingestion of nickel-contaminated soil. The respiratory system is the primary target of nickel exposure following inhalation. Manifestations such as inflammation of the lungs, fibrosis, macrophage hyperplasia, and increased lung weight have been noted in animals exposed to nickel. Animals exposed to nickel through oral exposure were noted to have lethargy, ataxia, irregular breathing, salivation, and squinting (ATSDR 1996).

D.6.1 Nickel Toxicity to Birds

No studies pertaining to the dietary toxicity of nickel to the American robin were found. Therefore, literature pertaining to the dietary toxicity of nickel to other bird species was reviewed and used to assess the toxicity of nickel to the American robin.

Hill and Camardese (1986) reported that no overt signs of toxicity were observed in Japanese quail fed 5000 mg/kg nickel sulfate (1896.5 mg Ni/kg BW/day) in their diet for five days. Weber and Reid (1968) conducted a study in which Hubbard broiler chicks were exposed to nickel in their diet for four weeks. Feeding levels at or greater than 500 mg/kg (31 mg/kg BW/day) of Ni, as nickel sulfate, resulted in significantly depressed weight gains. The NOAEL for this effect was 17 mg/kg BW/day. However, the authors noted in this study that the feed conversion did not differ significantly at the lower doses used in the study, up to a dose of 900 mg/kg in food, above which the feed conversion increased. This indicates that the depressed weight gain at the lower doses may have been due to a reduction in food intake. Furthermore, since feed intake increased at the higher doses, this indicates that the reduction in food intake at the lower doses was not a result of a toxic effect of nickel. In another study, Cain and Pafford (1981) exposed mallard ducklings to dietary nickel (as nickel sulfate) for 90 days, and tremors were observed at a concentration of 774 mg/kg Ni (132 mg/kg BW/day). A decrease in the weight/length ratio of the humerus in females was also observed at this concentration up to 60 days, but was not observed at 90 days. The NOAEL associated with this effect was 176 mg/kg (30 mg/kg BW/day).

For this study, a LOAEL of 132 mg/kg BW/day and a NOAEL of 30 mg/kg BW/day were used to estimate the risk of nickel to worm-eating birds.

D.6.2 Nickel Toxicity to Mammals

No studies pertaining to the dietary toxicity of nickel to the short-tailed shrew were found. Therefore, literature pertaining to the dietary toxicity of nickel to other mammals was reviewed and used to assess the dietary toxicity of nickel to the short-tailed shrew.

In a 2-year dietary study on rats, a dose of 50 mg/kg BW/day resulted in a decrease in body weight, an increase in heart-to-body weight ratios, and a decrease in liver-to-body weight ratios

(Ambrose et al. 1976). Ambrose et al. (1976) studied the effects of a dietary exposure to rats (Wistar strain) over three generations. The results of this study indicated a decrease in body weight of weanlings at a dose of 50 mg/kg BW/day, with a corresponding NOAEL for this effect of 25 mg/kg BW/day. However, at the lowest dosage, 12.5 mg/kg BW/day in the diet, an increased number of stillborns was observed in the first generation.

The latter study was used to develop the NOAEL and LOAEL values because of the ecological significance of the endpoint (stillbirths) and the duration of the exposure. A LOAEL of 12.5 mg/kg BW/day and an estimated NOAEL of 1.25 mg/kg BW/day were used to evaluate the risk posed by nickel to worm-eating mammals.

D.7 Vanadium

Vanadium (V) is a ubiquitous element. It is a by-product of petroleum refining, and vanadium pentoxide is used as a catalyst in various chemicals including sulfuric acid. It is also used in the hardening of steel, pigment manufacturing, photography, and insecticides.

Average concentrations in public water supplies range between 1 and 6 $\mu\text{g/L}$. Use of petroleum products or oil refineries are suspected sources of airborne vanadium. Vanadium has strong affinity for fats and oils. Within the body, fat is the compartment with the largest stores of vanadium. The principal route of excretion is in urine. When excess concentrations are taken in, vanadium can be found in high concentrations in the red blood cells (Klassen et al. 1986).

The toxic action of vanadium is largely confined to the respiratory tract because inhalation is the most common route of exposure. Ingestion of vanadium compounds (V_2O_5) may lead to acute poisoning characterized by marked effects on the nervous system, hemorrhage, paralysis, convulsions, and respiratory depression. It has been suggested that subacute exposures at high concentrations may adversely affect the liver, adrenals, and bone marrow (Klassen et al. 1986).

D.7.1 Vanadium Toxicity to Birds

No studies pertaining to the dietary toxicity of vanadium to the American robin were found. Therefore, literature pertaining to the dietary toxicity of vanadium to other birds was reviewed and used to assess the dietary toxicity of vanadium to the American robin.

When broiler strain chicks were fed diets containing 30 mg/kg of vanadium as the calcium salt from day 7 to 28, growth of the chicks was significantly reduced (Romoser et al. 1961). In another study, when chicks were fed diets containing 0, 25, 50 and 100 mg/kg of vanadate (as calcium orthovanadate) from 1 day to 15 months of age, the 50 and 100 mg/kg diets caused a 15 to 30 percent reduction in growth at the onset of egg production (25 weeks) and delayed sexual maturity (Phillips et al. 1982). No information was given in either of these studies to convert the food concentrations to doses in units of mg/kg BW/day. Mallard ducks were fed 1, 10 and 100 mg/kg vanadium in the diet for 12 weeks, and altered lipid metabolism was observed in laying hens fed the 100 mg/kg diet, but no mortality or changes in body weights were observed at any of the food concentrations (White and Dieter 1978). When 28-week old White Leghorn hens were fed a diet containing 300 mg/kg vanadium (18 mg/kg BW/day) for one month, a significant reduction in egg production was observed, whereas a diet containing 100 mg/kg showed no effect (Hafez and Kratzer 1976). When 50-week old White Leghorn hens were fed diets containing 30 mg/kg (1.8 mg/kg BW/day) of vanadium, a decrease in egg production was observed (Berg et al. 1963). When laying White Leghorn hens were fed diets containing 40 mg/kg (2.6 mg/kg BW/day) of vanadium (as ammonium vanadate) for four weeks or more, a significant reduction in feed intake, body weight, egg weight, and shell quality was observed (Ousterhout and Berg 1981).

When 33-week old Single Comb White Leghorns were fed diets containing either 20 mg/kg or 30 mg/kg vanadium for four weeks, no effect on rate of egg production or feed intake was observed. However, decreased body weight gain was observed in birds receiving the 30 mg/kg (1.8 mg/kg BW/day) dose (Eyal and Morgan 1984). In another study, 25-week old Leghorn hens were fed diets containing 20 mg/kg (1.3 mg/kg BW/day) of vanadium as ammonium metavanadate in the diet for 14 days, after which egg production and feed consumption were significantly lower than that of the control group by day 14 (Toussant and Latshaw 1994). In another study, Common rock pigeons (*Columba livia intermedia*) were fed a diet containing 0.048 mg/kg (0.004 mg/kg BW/day) of vanadium (in the form of ammonium metavanadate) for one month, which resulted in a significant decrease in body weight, low physical activity, and green diarrhea, as well as hypertrophy in the testicular tubules and interstitial cells and follicular atresia in the ovary (Diwan and Belsare 1987).

Due to the ecological significance of the effects observed in the Toussant and Latshaw (1994) study compared with the Diwan and Belsare (1987) study, a LOAEL of 1.3 mg/kg BW/day and a NOAEL of 0.13 mg/kg BW/day (using an accepted conversion factor of 10) were used to assess the effects of vanadium on worm-eating birds.

D.8 Zinc

Zinc (Zn) is essential for normal growth and reproduction in plants and animals and is regulated by metallothioneins. Metallothioneins act as temporary zinc storage sites and aid in reducing the toxicity of zinc to both vertebrates and invertebrates (Olsson et al. 1989). Zinc is not known to bioaccumulate in food chains, because it is regulated by the body and excess zinc is eliminated.

Zinc has its primary metabolic effect on zinc-dependant enzymes that regulate the biosynthesis and catabolic rate of RNA and DNA. High levels of zinc induce copper deficiency and interfere with metabolism of calcium and iron (Goyer 1986). The pancreas and bone seem to be the primary targets of zinc toxicity in birds and mammals. Pancreatic effects include cytoplasmic vacuolation, cellular atrophy, and cell death (Lu and Combs 1988; Kazacos and Van Vleet 1989). Zinc preferentially accumulates in bone, and induces osteomalacia, a softening of bone caused by a deficiency of calcium, phosphorus and other minerals (Kaji et al. 1988). Gill epithelium is the primary target site in fish. Zinc toxicosis results in destruction of gill epithelium and tissue hypoxia (Spear 1981).

D.8.1 Zinc Toxicity to Birds

No studies pertaining to the dietary toxicity of zinc to the American robin were found. Therefore, literature pertaining to the dietary toxicity of zinc to other bird species was reviewed and used to assess the toxicity of zinc to the American robin.

Mallard ducks exposed to 600 mg/kg BW/day zinc for a period of 30 days suffered from leg paralysis and a decrease in food consumption (NAS 1979). In another study, one-day old chicks exposed to 253 mg/kg BW/day exhibited no decrease in body weight or food consumption (Oh et al. 1979). Chicks of the domestic chicken exposed to 361 mg/kg BW/day zinc for two weeks had reduced body weight, serum cholesterol, and growth hormones, and thyroid follicular hyperplasia and hypertrophy (Dean et al. 1991). In a similar study, Stahl et al. (1989) found that chicks exposed to 145 mg/kg BW/day zinc showed decreased growth and anemia. Japanese quail exposed to 139 mg/kg BW/day zinc suffered from mortality and reduced food intake (Hill and Camardese 1986).

The latter study was used to derive a LOAEL of 139 mg/kg BW/day, and a NOAEL of 13.9 mg/kg BW/day was derived from the LOAEL using an accepted conversion factor of 10. These values were used in this study to evaluate the risk posed by zinc to worm-eating birds.

D.8.2 Zinc Toxicity to Mammals

No studies pertaining to the dietary toxicity of zinc to the short-tailed shrew were found in the literature. Therefore, literature pertaining to the dietary toxicity of zinc to other mammals was reviewed and used to assess the dietary toxicity of zinc to the short-tailed shrew.

Mice fed a diet containing 600 mg/kg BW/day zinc suffered from anemia (Walters and Roe 1965). Mice exposed to 317 mg/kg BW/day zinc had reduced plasma copper, lowered hematocrit, reduced body weight, and hair loss (Mulhern et al. 1986). Long-Evans rats exposed to a diet containing 300 mg/kg BW/day zinc showed reduced growth rate, anemia, reduction in hemoglobin and red blood cell volume, and copper deficiency (Cox and Harris 1960). Dogs exposed for a period of one year to 25 mg/kg BW/day zinc showed no adverse effects (NAS 1979). European ferrets exposed to a diet of 371 mg/kg BW/day zinc suffered from weight loss, decrease in food intake, and had soft and enlarged kidneys (Straube et al. 1980). Schlicker and Cox (1968) exposed Sprague-Dawley rats for 37 days during mating and gestation to two dose levels of zinc oxide through the diet. The study identified a LOAEL of 320 mg/kg BW/day and a NOAEL of 160 mg/kg BW/day for reproduction (fetal absorption) and fetal growth.

The latter study was used to evaluate the risk posed by zinc to mammals because of the ecological significance of the endpoints and the timing and duration of exposure. For the purposes of this study, dietary levels of 320 mg/kg BW/day of zinc will be used as a LOAEL and 160 mg/kg BW/day will be used as a NOAEL for worm-eating mammals.

D.9 β -BHC

β -BHC (beta-benzene hexachloride) is present in technical mixtures of BHC at approximately 6 to 8 percent. BHC was formerly used in the United States as an insecticide. Unlike γ -BHC (lindane), β -BHC is a central nervous system depressant, and it causes lameness and a peculiar flaccidity of the entire musculature. β -BHC is not as toxic as γ -BHC, and in fact has been shown to partially ameliorate the toxic effects of γ -BHC (HSDB 1997). The exception to this is that β -BHC is a strong irritant to the eye, nose, throat, and skin, while γ -BHC is not. The differences in toxicity of the two isomers is due to the fact that a rigid spatial arrangement of the molecule (i.e., the gamma isomer) is necessary for strong insecticidal activity (Matsumura 1975).

It is generally accepted that BHC can be degraded much more readily under anaerobic conditions than under aerobic conditions, although it is believed that β -BHC is not degraded to the extent that γ -BHC is (Matsumura 1975). Isomerization under the influence of heat has also been reported. β -BHC has also been found to accumulate in tissue to a greater extent than γ -BHC. The tissues that accumulate β -BHC most significantly include adipose tissue, the kidneys, and the adrenals. This accumulation is related to its low rate of metabolism and transport (HSDB 1997).

Two metabolic pathways have been suggested, one of which includes the hydroxylation of 1,3,5-trichlorobenzene, one of the products of dehydrochlorination. An alternative pathway has been proposed in which direct hydroxylation to alpha-chlorohydrins, followed by rapid, spontaneous loss of HCL, yields one of the isomers of pentachlorocyclohexanone, which rapidly loses two molecules of HCL, yielding 2,4,6-trichlorophenol. These metabolic reactions are believed to be oxidative and catalyzed by cytochrome P450 (HSDB 1997).

D.9.1 β -BHC Toxicity to Mammals

No studies pertaining to the dietary toxicity of β -BHC to the short-tailed shrew were found in the literature. Therefore, literature pertaining to the dietary toxicity of β -BHC to other mammals was reviewed and used to assess the dietary toxicity of β -BHC to the short-tailed shrew.

In a 30-day feeding study in rats, 600 mg/kg (45 mg/kg BW/day) of β -BHC in the diet caused delayed growth, enlarged livers, and a decrease in brain mass (Macholz et al. 1986). When groups of 10 male and 10 female Wistar rats were fed diets containing 10 to 1600 mg/kg of β -BHC for their lifespan, weight gain was significantly reduced in females receiving 100 mg/kg (5 mg/kg BW/day) in the diet (Fitzhugh et al. 1950).

For this study, a dietary exposure level of 5 mg/kg BW/day was used as a LOAEL and a dietary exposure level of 0.5 mg/kg BW/day was used as a NOAEL to estimate the risk from β -BHC to worm-eating mammals.

D.10 γ -BHC (Lindane)

Lindane, or γ -BHC, has been used as an insecticide for field crops such as corn and wheat, for ornamentals, for pasture and forage crops, for forestry and timber protection, for soil and seed treatment and viticulture, in medications, and in baits for rodent control. When released into water, lindane is not expected to volatilize significantly. It is also not expected to hydrolyze in acidic or neutral water, but in basic water, hydrolysis might be significant. Lindane has also been reported to photodegrade, but this is not expected to be a significant fate process. When released into soil, lindane will most likely volatilize and slowly leach into the groundwater. Lindane will also biodegrade moderately under aerobic conditions and significantly under anaerobic conditions. With a log octanol-water partition coefficient (log Kow) of 3.72, lindane is expected to bioconcentrate slightly. Measured bioconcentration factors range from 63 in grass shrimp to 1613 in northern brook silverside (HSDB 1997).

The mechanism of toxicity of lindane is unknown. However, it is thought that lindane might interact with pores of the lipoprotein structure of insect nerves causing distortion and consequent excitation of nerve impulse transmission. The main metabolites of lindane found in human urine have been 2,4,6-, 2,3,5-, and 2,4,5-trichlorophenol. These metabolites have also been found either free or as conjugates in the urine of rats after intraperitoneal (i.p.) injection. In mice, urinary metabolites consisted mostly of the glucuronide and sulfate conjugates of 2,4,6-trichlorophenol and 2,4-trichlorophenol after i.p. injection. After oral ingestion of lindane by rats, 3,4-dichlorophenol, 2,4,6-trichlorophenol, 2,3,4,5- and 2,3,4,6-tetrachlorophenol, and 2,3,4,5,6-pentachloro-2-cyclohexene-1-ol were excreted in urine (HSDB 1997).

D.10.1 γ -BHC Toxicity to Mammals

No studies pertaining to the dietary toxicity of γ -BHC to the short-tailed shrew were found in the literature. Therefore, literature pertaining to the dietary toxicity of γ -BHC to other mammals was reviewed and used to assess the dietary toxicity of zinc to the short-tailed shrew.

When groups of 10 male and 10 female Wistar rats were fed diets containing 10 to 1600 mg/kg of γ -BHC for their lifespan, mortality was significantly higher in the groups receiving the 800 mg/kg (60 mg/kg BW/day) diet (Fitzhugh et al. 1950). In a 30-day feeding study in rats, 125 mg/kg (9.4 mg/kg BW/day) of γ -BHC in the diet caused growth retardation (Macholz et al. 1986). In another study in which rabbits received an oral dose (via gavage) of commercial lindane at 4.21 mg/kg BW/day for 28 days, a decrease in weight gain and food consumption was observed (Ceron et al. 1995). In another study, adult cotton mice and old-field mice received lindane in the diet at dosages of 24.4 and 39 mg/kg BW/day, respectively, for 8 months. No adverse effects on

survival, reproduction, development of the young, or behavior were observed (Wolfe and Esher 1980). When beagle bitches were given 7.5 or 15 mg/kg BW/day from day 5 through gestation, an increased incidence in stillborn pups was observed (Earl et al. 1973). When mink were fed a doses of 1 mg/kg BW/day of lindane in the diet for three weeks prior to breeding until mating, there was a significant decrease in the percentage of females accepting a second mating, but there were no significant differences in the proportion of male or female kits born or the growth rate of kits up to weaning at eight weeks (Rawlings et al. 1995). When ram lambs born to ewes which were on a diet of 1 mg/kg BW/day of lindane were maintained on the same diet from weaning until sexual maturity at 26 weeks, a decrease in libido was accompanied by a decrease in serum concentrations of luteinizing hormone and a decrease in testosterone secretion following gonadotropin releasing hormone (Beard et al. 1997). In another study, exposure of female mink to 1 mg/kg BW/day of lindane from conception resulted in a severe reduction in fertility when they were subsequently bred, resulting in a 60 percent decrease in the number of kits born (Cook et al. 1997). When 0.5 mg/kg BW/day was given orally to female rats for four months, disturbances in the oestrous cycle, a decreased capacity for conception and fertility, and lowered viability and delayed physical development of embryos were observed (Naishtein and Leibovich 1971).

For this study, a dietary exposure level of 0.5 mg/kg BW/day was used as a LOAEL and a dietary exposure level of 0.05 mg/kg BW/day was used as a NOAEL to estimate the risk from γ -BHC to worm-eating mammals.

D.11 DDT

DDT is hydrophobic, and thus would not be expected to be present in surface waters at high concentrations. The majority of DDT entering aquatic systems is expected to accumulate in sediments and biological tissues. DDT is known to accumulate in biological tissues, particularly lipids, where it may be stored for extended periods of time and be passed on to higher trophic level organisms. Several studies have indicated that DDT biomagnifies, or is found in biological tissues at increasing concentrations at higher trophic levels. Biologically accumulated DDT may be metabolized to another form (e.g., DDT may be transformed to DDE). When fat reserves are metabolized, the DDT or transformed metabolite is released into the system, where it may result in a toxic response. DDT may act as a direct toxin to some receptors; however, because of its tendency to concentrate in biological tissues, higher trophic level receptors may be at increased risk through ingestion of contaminated food sources.

DDT appears to affect the reproductive success of many receptors. One well documented response is eggshell thinning in birds, in which the activity of Ca^{2+} ATP-ase systems in the shell gland are affected, thereby interfering with the deposition of calcium in the shell (Lundholm 1987; Lundholm 1988; Miller et al. 1976). Eggshell thinning of greater than 20 percent has been associated with decreased nesting success due to eggshell breakage (Anderson and Hickey 1972; Dilworth et al. 1972). Because of the tendency of DDT to magnify in food chains, higher trophic level birds (e.g., piscivorous, raptors) appear to be at greater risk for egg loss due to shell thinning.

Another well defined effect of DDT exposure is inhibition of acetylcholinesterase (AChE) activity. Inhibition of this enzyme results in the accumulation of acetylcholine in the nerve synapses, resulting in disrupted nerve function. Chronic inhibition of 50 percent of brain AChE has been associated with mortality in birds (Ludke et al. 1975; Hill and Fleming 1982).

The effects of DDT on other receptor groups are not as clearly defined as in birds. Recent studies indicate that DDT (especially *o,p'* isomers) may mimic estrogen, resulting in adverse reproductive effects. Observed effects include feminization and increased female:male population ratios for some receptors.

Other responses include histopathological changes, alterations in thyroid function, and changes in the activity of various enzyme groups (Peakall 1993).

D.11.1 DDT Toxicity to Birds

No literature was found pertaining to the dietary toxicity of DDT to the American robin. Therefore, literature pertaining to the dietary toxicity of DDT to other bird species was reviewed.

An acute oral LC50 of >1,200 mg/kg BW was reported for the sandhill crane (Hudson et al. 1984). An acute dietary LD50 of 1,869 mg/kg, dry weight, was reported for the mallard duck (Heath et al. 1972). Another study was found that examined the dietary toxicity of DDT to a passerine bird species. Bengalese finches (*Lonchura striata*) were fed diets contaminated with DDT from six weeks prior to pairing until fledging of the young had occurred. Ingestion of diets containing 8 mg/kg DDT (equivalent to 2.49 mg/kg BW/day) reduced fertility, hatchability, and fledging success (Jefferies 1971). In another study, when mallard ducks were fed diets containing 20 mg/kg DDT (2.04 mg/kg BW/day) for either 78 or 343 days, a significant increase in the percentage of cracked or broken eggs and a decrease in eggshell thickness was observed. At a dose of 2 mg/kg DDT (0.19 mg/kg BW/day), no adverse effects were noted (Davison and Sell 1974).

A LOAEL of 2.04 mg/kg BW/day and a NOAEL of 0.19 mg/kg BW/day were used in this study to evaluate the dietary toxicity of DDT to worm-eating mammals.

D.12 Dieldrin

Dieldrin is a non-systemic and persistent cyclodiene insecticide. It was broadly used in the United States until 1974, when the U.S. EPA restricted its use to termite control via direct soil injection and for non-food seed and plant treatment. Dieldrin is no longer produced commercially in the United States (HSDB 1997).

Dieldrin is extremely persistent in the environment due to its extremely low volatility and low solubility in water. The time required to degrade 95 percent of dieldrin in soil has been estimated to vary from 5 to 25 years. It is highly lipophilic and is therefore prone to bioaccumulate and biomagnify (HSDB 1997). A variety of bioconcentration factors have been calculated for dieldrin, ranging from 128 for an alga to 68,286 for whole body yearling lake trout (U.S. EPA 1980).

In the aquatic environment, dieldrin is extremely toxic, with 96-hour acute LC50s ranging from 5.0 ug/L for the isopod *Asellus brevicaudus* to 740 ug/L for a crayfish. For fish, the most sensitive species is the rainbow trout, with a 96-hour LC50 of between 1.1 and 9.9 ug/L. The most resistant fish species is the goldfish, with a 96-hour LC50 of 41 ug/L. In a chronic study using *Daphnia magna*, a chronic value of 57 ug/L was obtained. Two chronic studies have been conducted using fish. One was an early-life stage exposure using rainbow trout in which a chronic value of 0.22 ug/L was obtained. The other study was a three-generation study using the guppy, in which a chronic value of 0.45 ug/L was obtained (U.S. EPA 1980).

In mammals, dieldrin is rapidly absorbed from the GI tract upon ingestion. It is then transported from the liver to various tissues in the body, including the brain, blood, liver, and adipose tissue. Dieldrin is metabolized by the mixed function oxidase (MFO) enzyme system. For most species (rat, mouse, dog, monkey, and sheep), the acute oral toxicity is between 20 and 70 mg/kg. The toxicity appears to be related to the central nervous system, with stimulation, hyperexcitability, hyperactivity, incoordination, and exaggerated body movement, ultimately leading to confusion, depression, and death (U.S. EPA 1980).

Dieldrin has been shown to cross the placental barrier, and for that reason has been studied for its teratogenic properties and reproductive effects. When mice were fed 25 mg/kg of dieldrin in the diet for six generations, parameters such as fertility, gestation, viability, lactation, and survival of the young were adversely affected. When hamsters were fed one dose equivalent to one-half the LD50 of dieldrin, increased fetal death, decreased fetal growth, open eye, webbed feet, cleft palate, and other effects were observed. Two later studies were performed in which lower dosages of dieldrin were administered, and equivocal results were obtained (U.S. EPA 1980).

In birds, the oral LD50 of dieldrin was determined to be 6.9 mg/kg BW using the sharp-tailed grouse. A variety of reproductive effects have also been observed in birds, including decreased egg production and fertility. Studies have shown that organochlorine insecticides induce liver enzymes that lower estrogen levels and result in late breeding and other related reproductive manifestations. A correlation has also been established between egg concentrations of dieldrin, eggshell thickness, and hatching success. In addition, studies in male chickens, pheasants and quail have indicated that dieldrin causes a reduction in testicular size and alters hormone metabolism (U.S. EPA 1976).

D.12.1 Dieldrin Toxicity to Birds

No studies were found in which the dietary toxicity of dieldrin to the American robin were evaluated. Therefore, studies in which the dietary toxicity of dieldrin to other bird species were reviewed.

Three studies were found in which the toxic effects of dieldrin to mallard ducks were evaluated. In one study, exposure of mallard ducks (*Anas platyrhynchos*) to dietary concentrations of dieldrin ranging from 4 to 30 mg/kg dieldrin (0.36 to 2.7 mg/kg BW/day) for 75 days resulted in a decrease in the biogenic amines serotonin, norepinephrine, and dopamine (Sharma et al. 1976). However, due to the nature of the endpoints evaluated in this study, toxicity studies evaluating endpoints with more ecological significance using other bird species were used in this study to evaluate the dietary toxicity of dieldrin to the American robin.

Adverse reproductive effects were observed in pheasants exposed to a concentration of 25 and 50 mg/kg dieldrin (4.3 and 8.75 mg/kg BW/day) in their diet (Genelly and Rudd 1956). Hungarian partridges exposed to 3 mg/kg dieldrin (0.5 mg/kg BW/day) in their diet for 90 days during the breeding season resulted in decreased egg production and hatchability (Neill et al. 1969). Heath et al. (1972) reported an acute LD50 of 6 mg/kg BW/day for the bobwhite quail. Chickens exposed to 5 mg/kg dieldrin (0.9 mg/kg BW/day) in their diet showed no effects on egg production or hatchability (Graves et al. 1969). It was estimated that the lowest observed adverse effect level of dieldrin in brown pelican (*Pelecanus occidentalis*) eggs is approximately 1 mg/kg (0.3 mg/kg BW/day) in their diet (Blus 1982). Eggshells of normal thickness were laid by pheasants fed a diet containing approximately 0.1 mg/kg BW/day dieldrin (Dahlgren and Linder 1974).

A LOAEL 0.3 mg/kg BW/day and a NOAEL of 0.1 mg/kg BW/day will be used in this study to evaluate the dietary toxicity of dieldrin to worm-eating birds.

D.12.2 Dieldrin Toxicity to Mammals

No studies were found in which the dietary toxicity of dieldrin to the short-tailed shrew were evaluated. Therefore, studies in which the dietary toxicity of dieldrin to other mammal species were reviewed.

In a 128-week study, no adverse effects were noted in mice exposed to 0.1 and 1 mg/kg dieldrin (0.013 and 0.13 mg/kg BW/day) in their diet (Walker et al. 1972). In a similar study, no effect on

mortality or longevity was observed in three generations of rats exposed to 0.5, 1.25, and 25 mg/kg dieldrin in the diet (0.15, 0.75, and 1.5 mg/kg BW/day), however, a significant increase in the liver/body weight ratio was observed at all concentrations (Treon and Cleveland 1955). Another chronic study resulted in no significant pup mortality when mice were fed a dose of 0.33 mg/kg BW/day of dieldrin (Virgo and Bellward 1975). In another study, rats of varying ages (28 to 750 days old) were exposed to dietary concentrations of dieldrin ranging from 0.08 to 40 mg/kg (Harr et al. 1970b). The exposure resulted in nonspecific neural and vascular lesions, cranial edema, and convulsions at dietary concentrations of 2.5 mg/kg (0.11 mg/kg BW/day) and greater; no effects were noted at dietary concentrations of 1.25 mg/kg (0.058 mg/kg BW/day) or less. When rats were exposed to dietary concentrations ranging from 0.08 mg/kg to 40 mg/kg of dieldrin in the diet, the concentration of 0.31 mg/kg (0.018 mg/kg BW/day) was the lowest concentration that resulted in adverse reproductive effects, including a reduction in pup survival and conception rate (Harr et al. 1970a). In this study, the highest dose that did not produce any reproductive effects was 0.16 mg/kg (0.009 mg/kg BW/day).

For the purposes of this study, a LOAEL of 0.018 mg/kg BW/day and a NOAEL of 0.009 mg/kg BW/day will be used to evaluate the dietary toxicity of dieldrin to nonmammalian mammals.

D.13 Endrin

Endrin was used as an insecticide, avicide, and rodenticide. Its general toxic effects include ataxia, slowness, drowsiness, tremors, tracheal congestion, prostration, convulsions, wingbeat convulsions, and opisthotonos. Formulations of endrin generally contain impurities or related compounds, including endrin aldehyde and endrin ketone. These two chemicals are also known to be metabolites of the parent endrin compound (HSDB 1997).

When endrin is released into the soil, it is not expected to migrate into the groundwater due to its expected strong adherence to soil particles. However, the detection of small amounts of endrin in some samples of groundwater indicate that some migration is possible. Endrin will persist in soil for long periods of time (up to 14 years or more). Small amounts of endrin may volatilize, and it has been shown to biodegrade to endrin ketone. However, biodegradation and hydrolysis are not important removal mechanisms. When endrin enters aquatic systems, it is expected to adsorb strongly to sediments, thus providing a potential aquatic transport mechanism, and evaporation from water is not expected to be significant. Endrin aldehyde and endrin ketone are expected to have a very similar fate in the environment as endrin (HSDB 1997).

The toxic mechanism of endrin is believed to include inhibition of the acetylcholinesterase (AChE) butylbicyclophosphorothionate binding site. It has also been shown that endrin produces specific alterations in unmyelinated fiber bundles of peripheral nerves but does not affect myelinated fibers. A variety of metabolites of endrin have been identified, including endrin ketone, 2-*tert*-butyl-4-hydroxy-2-methyl-5-pyridinecarboxaldehyde, as mentioned previously. Additional metabolites that are believed to be significant include 9-ketoendrin, 9-hydroxyendrin, 3-hydroxyendrin, and trans-4,5-dihydroendrin-4-ol. Bioconcentration factors (BCFs) have been calculated, ranging from 140 in the guppy to seven million, 49,000 in a species of snail (Physa). In fish, the BCFs have been calculated for a variety of species and range from 1335-10,000 (HSDB 1997).

Endrin has been shown to be extremely toxic to aquatic organisms. The toxicity of endrin has been tested in two species of *Daphnia*, resulting in 48-hour EC₅₀s of 4.2 and 2.1 µg/L for *Daphnia magna* and *Daphnia pulex*, respectively. In addition, 96-hour LC₅₀s for twelve species of nonmammalian vertebrates ranged from 0.08 to 62 µg/L. In eleven species of fish, the 96-hour LC₅₀s ranged from 0.23 µg/L in *Ophiocephalus punctatus* to 1.8 µg/L in the fathead minnow (HSDB 1997).

Anderson, D.W. and J.J. Hickey. 1972. "Eggshell changes in certain North American birds." In: *Proceedings: XV International Ornithological Congress*. Ed. K.H. Voous, The Hague. Netherlands. p. 514-540.

ATSDR (Agency for Toxic Substances and Disease Registry). 1990a. *Toxicological Profile for Aluminum*. Report prepared by the Research Triangle Institute for the U.S. Department of Health and Human Service, Agency for Toxic Substances and Disease Registry, Atlanta, GA.

ATSDR (Agency for Toxic Substances and Disease Registry). 1990b. *Toxicological Profile for Manganese*. Report prepared by the Research Triangle Institute for the U.S. Department of Health and Human Service, Agency for Toxic Substances and Disease Registry, Atlanta, GA.

ATSDR (Agency for Toxic Substances and Disease Registry). 1996. *Toxicological Profile for Nickel*. Report prepared by the Research Triangle Institute for the U.S. Department of Health and Human Service, Agency for Toxic Substances and Disease Registry, Atlanta, GA.

Armstrong, F.A.J. 1979. "Effects of Mercury Compounds in Fish." In: *The Biogeochemistry of Mercury in the Environment*. Ed. J.O. Nriagu. New York: Elsevier/North-Holland Biomedical Press. p. 657-670.

Azar, A., H.J. Trochimowicz, and M.E. Maxwell. 1973. "Review of Lead Studies in Animals Carried Out at Haskell Laboratory: Two-Year Feeding Study and Response to Hemorrhage Study." In: *Environmental Health Aspects of Lead: International Symposium*. Eds. D. Barth et al. Commission of European Communities. p. 199-210.

Beard, A.P., P.M. Bartlewski, R.K. Chandolia, A. Honaramooz, and N.C. Rawlings. 1997. "Pituitary, Thyroid, and Testis Function in Rams Exposed to Organochlorine Pesticides from Conception." *Biology of Reproduction*, vol. 56, supplement 1: Thirtieth Annual Meeting of the Society for the Study of Reproduction, Portland, Oregon, USA, August 2-5, 1997, 200 p.

Beauford, W. J. Barber and A.R. Barringer. 1977. "Uptake and Distribution of Mercury within Higher Plants." *Physiol. Plant*, 39:261-265.

Beijer, K. and A. Jernelov. 1979. "Methylation of Mercury in Natural Waters." In: *The Biogeochemistry of Mercury in the Environment*. Ed. J.O. Nriagu. New York: Elsevier/North-Holland Biomedical Press. p. 201-210.

Beyer, W.N., J.W. Spann, L. Sileo, and J.C. Franson. 1988. "Lead Poisoning in Six Captive Avian Species." *Arch. Environ. Contam. Toxicol.*, 17:121-130.

Birge, W.J., J.A. Black and A.G. Westerman. 1979. "Evaluation of Aquatic Pollutants Using Fish and Amphibian Eggs as Bioassay Organisms." In: *Animals as Monitors of Environmental Pollutants*, Washington, D.C.: National Academy of Science. p. 108-118.

Blus, L. L. 1982. "Further Interpretation of the Relation of Organochlorine Residues in Brown Pelican Eggs to Reproductive Success." *Environmental Pollution*, (Series A), 28:15-33.

Borg, K., K. Erne, E. Hanko, and H. Wanntorp. 1970. "Experimental Secondary Methylmercury Poisoning in the Goshawk (*Accipiter g. gentilis* L.)." *Environ. Pollut.*, 1:91-104.

Cain, B.W. and E.A. Pafford. 1981. "Effects of dietary nickel on survival and growth of mallard ducklings." *Arch. Environ. Contam. Toxicol.* 10:737-745.

Ceron, J.J., C.G. Panizo, and A. Montes. 1995. "Toxicological Effects in Rabbits Induced by Endosulfan, Lindane, and Methylparathion Representing Agricultural Byproducts Contamination." *Bull Environ. Contam. Toxicol.*, 54:258-265.

- Clarkson, T.W. and D.O. Marsh. 1982. "Mercury Toxicity in Man." In: *Clinical, Biochemical, and Nutritional Aspects of Trace Elements*, Vol. 6. Ed. A.S. Prasad. New York: Alan R. Liss, Inc. p. 549-568.
- Cocking, D., R. Hayes, M.L. King, M.J. Rohrer, R. Thomas and D. Ward. 1991. "Compartmentalization of Mercury in Biotic Components of Terrestrial Floodplain Ecosystems Adjacent to the South River at Waynesboro, VA." *Water, Air and Soil Pollution*, 57-58:159-170.
- Cook, S.J., A.P. Beard, A.C. McRae, and N.C. Rawlings. 1997. "Fertility in Mink (*Mustela vison*) Exposed to Pesticides from Conception." *Biology of Reproduction*, vol. 56, suppl. 1: Thirtieth Annual Meeting of the Society for the Study of Reproduction, Portland, Oregon, USA, August 2-5, 1997, 200 p.
- Cox, D.H. and D.L. Harris. 1960. "Effects of Dietary Zinc on Iron and Copper in the Rat." *Journal of Nutrition*, 70:514-520.
- Dahlgren, J. H., and R. L. Linder. 1974. "Effects of Dieldrin in Panned Pheasants Through the Third Generation." *J. Wildlife Mgmt.*, 38:320-330.
- Das, S.K., A. Sharma, and G. Talukder. 1982. "Effects of Mercury on Cellular Systems in Mammals - A Review." *Nucleus* (Calcutta), 25:193-230.
- Davison, K.L. and J.L. Sell. 1974. "DDT Thins Shells of Eggs from Mallard Ducks Maintained on *ad libitum* or Controlled-Feeding Regimens." *Archives of Environ. Contam. and Toxicol.*, 2(3):222-232.
- Dean, C.E., B.M. Hargis, and P.S. Hargis. 1991. "Effects of Zinc Toxicity on Thyroid Function and Histology of Broiler Chicks." *Toxicological Letters*, 57:309-318.
- Dilworth, T.G., J.A. Keith, P.A. Pearce and L.M. Reynolds. 1972. "DDE and Eggshell Thickness in New Brunswick Woodcock." *J. of Wild. Manage.*, 36(4):1186-1193.
- Diwan, M. and D.K. Belsare. 1987. "Vanadium Effect on Endocrine Organs in Pigeon, *Columba livia intermedia*, Strickland." *J. Environ. Biol.*, 8(2):157-166.
- Dixon, R.L., R.J. Sherins, and I.P. Lee. 1979. "Assessment of Environmental Factors Affecting Male Fertility." *Environmental Health Perspectives*, 30:53-68.
- Earl, F.L., E. Miller, and E.J. Van Loon. 1973. "Reproductive, Teratogenic and Neonatal Effects of Some Pesticides and Related Compounds in Beagle Dogs and Miniature Swine." In: *Papers of the 8th Inter-America Conference on Toxicology and Occupational Medicine, Pesticides and the Environment: Continuing Controversy*, Ed. W.B. Deichmann, Vol. 2, New York: Stratton, p. 253-266.
- Ecological Analysts, Inc. 1981. "The Sources, Chemistry, Fate, and Effects of Chromium in Aquatic Environments." Washington, D.C.: American Petroleum Institute. 207 p.
- Edens, F.W., E. Benton, S.J. Bursian, and G.W. Morgan. 1976. "Effect of Dietary Lead on Reproductive Performance in Japanese Quail, *Coturnix coturnix japonica*." *Toxicol. App. Pharmacol.*, 38:307-314.
- Edens, F.W. and J.W. Laskey. 1990. "Serum chemistries of *Coturnix coturnix japonica* given dietary manganese oxide (MN3O4)." *Comp. Biochem. Physiol.*, 97C:139-142.
- Eisler, R. 1986. "Chromium Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review." U.S. Fish and Wildlife Service Biological Report, 85(1.86). 60 p.

- Eisler, R. 1987. "Mercury Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review." U.S. Fish and Wildlife Service Biological Report, 85(1.10). 90 p.
- Eisler, R. 1988. "Lead Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review." U.S. Fish and Wildlife Service Biological Report, 85(1.14). 134 p.
- Elhassani, S.B. 1983. "The Many Faces of Methylmercury Poisoning" *J. Toxicol.*, 19:875-906.
- Evan, A.P. and W.G. Dail. 1974. "The Effects of Sodium Chromate on the Proximal Tubules of the Rat Kidney." *Lab. Invest.*, 30:704-715.
- Eyal, A. and E.T. Moran. 1984. "Egg Changes Associated with Reduced Interior Quality Because of Dietary Vanadium Toxicity in the Hen." *Poultry Science*, 63:1378-1385.
- Fitzhugh, O.G., A.A. Nelson, and J.P. Frawley. 1950. "The Chronic Toxicities of Technical Benzene Hexachloride and its Alpha, Beta, and Gamma Isomers." *J. Pharmacol. Exp. Ther.*, 100:59-66.
- Genelly, R. E., and R. L. Rudd. 1956. "The Effects of DDT, Toxaphene, and Dieldrin on Pheasant Reproduction." *Auk*, 73:529.
- Gianutsos, G. and M.T. Murray. 1982. "Alterations in Brain Dopamine and GABA Following Inorganic or Organic Manganese Administration." *Neurotoxicol.*, 3:75-81.
- Goyer, R.A. 1986. "Toxic Effects of Metals." In: *Casarett and Doull's Toxicology. Third Edition*. Eds. C.D. Klaussen, M.O. Amdur, and J. Doull. New York: Macmillan. p. 582-635.
- Graves J. B., F. L. Bonner, W. F. McKnight, A. B. Watts, and E. A. Epps. 1969. "Residues in Eggs, Preening Glands, Liver, and Muscle from Feeding Dieldrin-Contaminated Rice Bran to Hens and its Effect of Egg Production, Egg Batch, and Chick Survival." *Bull. Env. Cont. & Toxicol.*, 4:375.
- Gray, L.E. and J.W. Laskey. 1980. "Multivariate Analysis of the Effects of Manganese on the Reproductive Physiology and Behavior of the Male House Mouse." *J. Toxicol. Environ. Health*, 6:861-867.
- Harr, J. R., R. R. Claeys, and N. Benedict. 1970. "Dieldrin Toxicosis in Rats: Long-Term Study of Brain and Vascular Effects." *Am. J. Vet. Res.*, 32:1853.
- Harr, J. R., R. R. Claeys, J.F. Bone, and T.W. McCorcle. 1970. "Dieldrin Toxicosis: Rat Reproduction," *Am. J. Vet. Res.*, 31:181-189.
- Haseltine, S.D., L. Sileo, D.J. Hoffman, and B.M. Mulhern. 1985. "Effects of Chromium on Reproduction and Growth of Black Ducks." Manuscript in preparation. Cited in: Eisler, R. 1986. "Chromium Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review." U.S. Fish and Wildlife Service Biological Report, 85(1.86). 60 p.
- Heath, R.G., J.W. Spann, E.F. Hill, and J.F. Kreitzer. 1972. "Comparative Dietary Toxicities of Pesticides to Birds." U.S. Fish and Wildlife Service. Fur. Fish. and Wildlife, Special Scientific Report, Wildlife No. 152. Washington, D.C.
- Heinz, G.H. and S.D. Haseltine. 1981. "Avoidance Behavior of Young Black Ducks Treated with Chromium." *Toxicol. Lett.*, 8:307-310.
- Hejtmancik, M., A.C. Peters, J.D. Toft, et al. 1987. "The Chronic Study of Manganese Sulfate Monohydrate (CAS No. 10034-96-5) in F344 Rats." Report to National Toxicology Program, Research Triangle Park, NC. Battelle, Inc.

- Heller, L.E. and Peniquite. 1937. "Factors producing and preventing perosis in chickens." *Poult. Sci.* 16:243-246.
- Hill, C.H. and G. Matrone. 1970. "Chemical Parameters in the Study of *in-vivo* and *in-vitro* Interactions of Transition Elements." *Fed. Proc.*, 29(4):1474-1481.
- Hill, E.F. and M.B. Camardese. 1986. "Lethal Dietary Toxicities of Environmental Contaminants and Pesticides to *Coturnix*." U.S. Fish and Wildlife Service. Fish and Wildlife Technical Report 2, Washington D.C.
- Hill, E.F. and W.J. Fleming. 1982. "Anticholinesterase Poisoning of Birds: Field Monitoring and Diagnosis of Acute Poisoning." *Environ. Toxicol. Chem.*, 1:27-38.
- Hill, E.F. and C.S. Schaffner. 1976. "Sexual Maturation and Productivity of Japanese Quail Fed Graded Concentrations of Mercury Chloride." *Poult. Sci.*, 55:1449-1459.
- Holl, W. and R. Hampp. 1975. "Lead and Plants." *Residue Rev.*, 54:79-111.
- Howard, P.H. 1991. "Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Volume III, Pesticides." Chelsea, MI: Lewis Publishers.
- HSDB (Hazardous Substances Data Bank). 1997. National Library of Medicine, Bethesda, Maryland (CD-ROM version), MICROMEDEX, Inc., Englewood, Colorado (Edition expires [1999]).
- Huckabee, J.W., J.M. Elwood, and S.G. Hildebrand. 1979. "Accumulation of Mercury in Freshwater Biota." In: *The Biogeochemistry of Mercury in the Environment*. Ed. J.O. Nriagu. New York: Elsevier/North-Holland Biomedical Press. p. 277-302.
- Hudson, R.H., R.K. Tucker, and M.A. Haegele. 1984. "Handbook of Toxicity of Pesticides to Wildlife." U.S. Fish and Wildl. Serv., Resour. Publ. 153. 90 p.
- Hussein, A.S., A.H. Cantor, and T.H. Johnson. 1988. "Use of High Levels of Dietary Aluminum and Zinc for Inducing Pauses in Egg Production of Japanese Quail." *Poultry Sci.*, 67:451-1165.
- Hussein, A.S., A.H. Cantor, T.H. Johnson, and R.A. Yokel. 1990. "Effects of Dietary Aluminum Sulfate on Calcium and Phosphorus Metabolism of Broiler Chicks." *Poultry Sci.*, 69:985-991.
- Jacquet, P., A. Leonard, and G.B. Gerber. 1976. "Action of Lead on Early Divisions of the Mouse Embryo." *Toxicology*, 6:129-132.
- James, B.R. and R.J. Bartlett. 1983a. "Behavior of Chromium in Soils: V. Fate of Organically Complexed Cr (III) Added to Soil." *J. Environ. Qual.*, 12:169-172.
- James, B.R. and R.J. Bartlett. 1983b. "Behavior of Chromium in Soils: VI. Interactions Between Oxidation-Reduction and Organic Complexation." *J. Environ. Qual.*, 12:169-172.
- Jefferies, D.J. 1971. "Some Sublethal Effects of pp'-DDT and its Metabolite pp'-DDE on Breeding Passerine Birds." *Meded. Fakult Landbouwwetenschappen Gent.*, 36:34-42.
- Kaji, T., R. Kawatani, M. Takata, T. Hoshino, T. Miyahara, H. Konzuka, and F. Koizumi. 1988. "The Effects of Cadmium, Copper or Zinc on Formation of Embryonic Chick Bone in Tissue Culture." *Toxicology*, 50:303-316.
- Kazacos, E.A. and J.F. Van Vleet. 1989. "Sequential Ultrastructural Changes of the Pancreas in Zinc Toxicosis in Ducklings." *American Journal of Pathology*, 134:581-595.

- Klassen, C.D., Amdur, M.O. and J. Doull. 1986. *Casarett and Doull's Toxicology*. 3rd. ed. New York, NY: MacMillan Publishing Company. 974 p.
- Komura, J. and M. Sakamoto. 1992. "Effects of manganese forms on biogenic amines in the brain and behavioral alterations in the mouse: long-term oral administration of several manganese compounds." *Environ. Res.*, 57:34-44.
- Kucher, I.M. and A.M. Shabanov. 1967. "Histochemical Investigation of the Pancreatic Islets in $K_2CR_2O_7$ Poisoning." *Gistokhim. Norm. Patol. Morfol.*, 353-357. Cited in *Chem. Abstr.*, 72:41127b (1970).
- Lal, B., A. Gupta, R.C. Murthy, M. Mohd Ali, and S.V. Chandra. 1993. "Aluminum Ingestion Alters Behaviour and Some Neurochemicals in Rats." *Indian J. Expt. Biol.*, 31:30-35.
- Laskey, J.W. and F.W. Edens. 1985. "Effects of chronic high-level manganese exposure on male behavior in the Japanese quail." *Poultry Science*, 5:37-48.
- Laskey, J.W., G.L. Rehnberg, and J.F. Hein. 1982. "Effects of Chronic Manganese (Mn_3O_4) Exposure on Selected Reproductive Parameters in Rats." *J. Toxicol. Environ. Health*, 9:677-687.
- Lawler, E.M., G.E. Duke, and P.T. Redig. 1991. "Effect of Sublethal Lead Exposure on Gastric Motility of Red-Tailed Hawks." *Arch. Environ. Contam. Toxicol.*, 21:78-83.
- Leeson, S. and J.D. Summers. 1982. "Effect of high dietary levels of supplementary zinc, manganese, copper, or iron on broiler performance to three weeks of age and accumulation of these minerals in tissue and excreta." *Nutrition Reports International*, 25:591-599.
- Lu, J. and G.F. Combs. 1988. "Effects of Excess Dietary Zinc on Pancreatic Exocrine Function in the Chick." *J. Nutrition*, 118:681-689.
- Ludke, J.L., E.F. Hill, and M.P. Dieter. 1975. "Cholinesterase Response and Related Mortality among Birds Fed Cholinesterase Inhibitors." *Arch. Environ. Contam. Toxicol.*, 3:1-21.
- Lundholm, E. 1987. "Thinning of Eggshells of Birds by DDE; Mode of Action on the Eggshell Gland." *Comp. Biochem. Physiol.*, 88C:1-22.
- Lundholm, E. 1988. "The Effects of DDE, PCB and Chlordane on the Binding of Progesterone to its Cytoplasmic Receptor in the Eggshell Gland Mucosa of Birds and the Endometrium of the Mammalian Uterus." *Comp. Biochem. Physiol.*, 89:361-368.
- Luster, M.I. et al. 1978. "Depression of Humoral Immunity in Rats Following Chronic Development Lead Exposure." *J. Envir. Pathol. Toxicol.*, 1:397-402.
- Macholz, R.M., D.W.R. Bleyl, H. Klepel, R. Knoll, M. Kujawa, H.J. Lewerenz, D. Muller, and R. Plass. 1986. "Comparison of Distribution and Toxicity of α -, β -, and γ -Hexachlorocyclohexane (HCH) after Application to Rats for 30 Days." *Die Nahrung*, 30:701-708.
- Mason, C.F. and S.M. MacDonald. 1986. "Levels of Cadmium, Mercury and Lead in Otter and Mink Feces from the United Kingdom." *Sci. Total Environ.*, 53:139-146.
- Matsumura, F. 1975. *Toxicology of Insecticides*. New York: Plenum Press, 503 p.
- McCollum, E.V., O.S. Rask, and J.E. Becker. 1928. "A Study on the Possible Role of Aluminum Compounds in Animal and Plant Physiology." *The Journal of Biological Chemistry*, 77:753-769.

- Miller, D.S., W.B. Kinter, and D.B. Peakall. 1976. "Enzymatic Basis for DDE-Induced Eggshell Thinning in a Sensitive Bird." *Nature*, 259:122-124
- Morgan, G.W., F.W. Edens, P. Thaxtona, and C.R. Parkhurst. 1975. "Toxicity of Dietary Lead in Japanese Quail." *Poult. Sci.*, 54:1636.
- Mulhern, S.A., W.B. Stroube, Jr. and R.M. Jacobs. 1986. "Alopecia Induced in Young Mice by Exposure to Excess Dietary Zinc." *Experientia*, 42:551-553.
- Naishtein, S.Y. and D.L. Leibovich. 1971. "Effect of Small Doses of DDT and Lindane and their Mixture on Sexual Function and Embryogenesis." *Hyg. Sanit.*, 36:190-195.
- NAS (National Academy of Sciences). 1979. *Zinc*. United States National Academy of Sciences, National Research Council, Subcommittee on Zinc. Baltimore, MD: University Park Press.
- Neill, D. D., J. V. Schutze, and H. D. Muller. 1969. "The Influence of Feeding Dieldrin and Parathion to the Hungarian Partridge on Reproduction." *Abst. 58th Ann. Meeting Poultry Sci. Assn.*, Ft. Collins, CO.
- Nicholson, J.K. and D. Osborn. 1984. "Kidney Lesions in Juvenile Starlings *Sturnus vulgaris* Fed on a Mercury-contaminated Synthetic Diet." *Environ. Pollut.*, 33A:195-206.
- Oh, S.H., H. Nakaue, J.T. Deagen, P.D. Whanger, and G.H. Arscott. 1979. "Accumulation and Depletion of Zinc in Chick Tissue Metallothionein." *J. Nutr.*, 109:1720-1729.
- Olsson, P.E., M. Zafarullah, and L. Gedamu. 1989. "A Role of Metallothionein in Zinc Regulation after Oestradiol Induction of Vitellogenin Synthesis in Rainbow Trout, *Salmo gairdneri*." *Biochemical Journal*, 257:555-559.
- Osborn, D., W.J. Eney, and K.R. Bull. 1983. "The Toxicity of Trialkyl Lead Compounds to Birds." *Environ. Pollut.*, 31A:261-275.
- Ousterhout, L.E. and L.R. Berg. 1981. "Effects of Diet Composition on Vanadium Toxicity in Laying Hens." *Poultry Science*, 60:1152-1159.
- Peakall, D. 1993. *Animal Biomarkers as Pollution Indicators*. Ecotoxicology Series 1. London, England: Chapman and Hall.
- Phillips, T.D., B.R. Nechay, S.L. Neldon, L.F. Kubena, N.D. Heidelbaugh, E.C. Shepherd, A.F. Stein, and A.W. Hayes. 1982. "Vanadium-Induced Inhibition of Renal Na⁺, K⁺-adenosinetriphosphatase in the Chicken after Chronic Dietary Exposure." *Journal of Toxicology and Environmental Health*, 9:651-661.
- Rawlings, N.C., A.C. McRae, and A.P. Beard. 1995. "Decreased Fertility in Female Mink (*Mustela vison*) Exposed to Low Doses of Pesticides." *Biology of Reproduction*, vol. 56, suppl. 1: Twenty-Eighth Annual Meeting of the Society for the Study of Reproduction, Davis, California, USA, July 9-12, 1995, p. 97.
- Redig, P.T., et al. 1991. "Effects of Chronic Exposure to Sublethal Concentrations of Lead Acetate on Heme Synthesis and Immune Function in Red-Tailed Hawks." *Arch. Environ. Contam. Toxicol.*, 21:72-77.
- Reiser, M.H. and S.A. Temple. 1981. "Effects of Chronic Lead Ingestion on Birds of Prey." In: *Recent Advances in the Study of Raptor Diseases*. Eds. J.E. Cooper and A.G. Greenwood. West Yorkshire, England: Chiron Publications Ltd. p. 21-25.

- Romoser, G.L., W.A. Dudley, L.J. Machlin, and L. Loveless. 1961. "Toxicity of Vanadium and Chromium for the Growing Chick." *Poultry Science*, 40:1171-1173.
- Scheuhammer, A.M. 1988. "Chronic Dietary Toxicity of Methylmercury in the Zebra Finch, *Poephila guttata*." *Bulletin of Environmental Contamination and Toxicology*, 40:123-130.
- Schlicker, S.A. and D.H. Cox. 1968. "Maternal Dietary Zinc, and Development and Zinc, Iron, and Copper Content of the Rat Fetus." *Journal of Nutrition*, 95:287-294.
- Sharma, R. P., D. S. Winn, and J. B. Low. 1976. "Toxic, Neurochemical, and Behavioral Effects of Dieldrin Exposure in Mallard Ducks." *Arch. Environ. Contam. Toxicol.*, 5:43.
- Stahl, J.L., M.E. Cook, M.L. Sunde, and J.L. Greger. 1989. "Enhanced Humoral Immunity in Progeny Chicks Fed Practical Diets Supplemented with Zinc." *Appl. Agricult. Res.*, 4:86-89.
- Steven, J.D., L.J. Davies, E.K. Stanley, R.A. Abbott, M. Inhat, L. Bidstrup, and J.F. Jaworski. 1976. "Effects of Chromium in the Canadian Environment." *Nat. Res. Coun. Can.*, NRCC No. 15017. 168 p.
- Straube, E.F., N.H. Schuster, and A.J. Sinclair. 1980. "Zinc Toxicity in the Ferret." *J. Comp. Pathol.*, 90:355-361.
- Spann, J.W., G.H. Heinz, and C.S. Hulse. 1986. "Reproduction and health of mallards fed endrin." *Environ. Toxicol. Chem.*, (5):755-759.
- Spear, P.A. 1981. "Zinc in the Aquatic Environment: Chemistry, Distribution, and Toxicology." National Research Council of Canada Publication. NRCC 17589. 145 p.
- Southern, L.L. and D.H. Baker 1983a. "*Eimeria acervulina* infection in chicks fed deficient or excess levels of manganese." *J. Nutr.* 113:172-177.
- Southern, L.L. and D.H. Baker 1983b. "Excess manganese ingestion in the chick." *Poultry Science*. 62:642-646.
- Toussant, M.J. and J.D. Latshaw. 1994. "Evidence of Multiple Metabolic Routes in Vanadium's Effects on Layers. Ascorbic Acid Differential Effects on Prepeak Egg Production Parameters Following Prolonged Vanadium Feeding." *Poultry Science*, 73:1572-1580.
- Treon, J.F. and F.P. Cleveland. 1955. "Toxicity of Certain Chlorinated Hydrocarbon Insecticides for Laboratory Animals with Special Reference to Aldrin and Dieldrin." *J. Agric. Food Chem.*, 3:402-408.
- U.S. Environmental Protection Agency (U.S. EPA). 1976. "Criteria Documents for Aldrin/Dieldrin." U.S. Environmental Protection Agency. Rep. EPA-440/9-76-008. 93 p.
- U.S. Environmental Protection Agency (U.S. EPA). 1980. *Ambient Water Quality Criteria for Aldrin/Dieldrin*. U.S. Environmental Protection Agency. Rep. EPA-440/5-80-019. 211 p.
- U.S. Environmental Protection Agency (U.S. EPA). 1988. "Pesticide Fact Handbook." Noyes Data Corporation, Mill Road, NJ.
- Virgo, B.B. and G.D. Bellward. 1975. "Effects of Dietary Dieldrin on Reproduction in the Swiss-Vancouver (SWV) Mouse." *Envir. Physiol. Biochem.*, 5:440-450.
- Vohra, P. and F.H. Kratzer. 1968. "Zinc, copper, and manganese toxicities in turkey poults and their alleviation by EDTA." *Poult. Sci.* 47:699-703.

Walker, A. I. T., E. Thorp, and D. E. Stevenson. 1972. "The Toxicology of Dieldrin; Long-Term Studies in Mice." *Food Cosmet. Toxicol.*, 11:415.

Walters, M. and F.J.C. Roe. 1965. "A Study of the Effects of Zinc and Tin Administered Orally to Mice over a Prolonged Period." *Fd. Cosmet. Toxicol.*, 3:271-276.

Weber, C.W. and B.L. Reid. 1968. "Nickel Toxicity in Growing Chicks." *J. Nutr.*, 95:612-616.

White, D.H. and M.P. Dieter. 1978. "Effects of Dietary Vanadium in Mallard Ducks." *Journal of Toxicology and Environmental Health*, 4:43-50.

Wisser, L.A., B.S. Heinrichs, and R.M. Leach. 1990. "Effect of aluminum on performance and mineral metabolism in young chicks and laying hens." *Am. J. of Nutrition*. 120:493-498.

Wixson, B.G. and B.E. Davis. 1993. "Lead in Soil." Lead in Soil Task Force, Science Reviews, Northwood. 132p.

Wolfe, J.L. and R.J. Esher. 1980. "Toxicity of Carbofuran and Lindane to the Old-Field Mouse (*Peromyscus polionotus*) and the Cotton Mouse (*P. gossypinus*)." *Bull. Environ. Contam. Toxicol.*, 24:894-902.

APPENDIX E

Life Histories and Exposure Profiles
Tennessee Products/Chattanooga Creek Superfund Site
Chattanooga, TN
February 1999

APPENDIX E

LIFE HISTORIES AND EXPOSURE PROFILES

E.1 *Chironomus tentans*

Life History (*Chironomus tentans*)

Chironomus tentans are widely distributed midges that are commonly found in eutrophic lakes, ponds, streams, and rivers throughout North America. The larvae of this insect are an important food source for fish, waterfowl, and larger aquatic invertebrates. They are generally found in upper sediment layers, and are rarely found at depths greater than 10 centimeters (cm) (U.S. EPA 1994).

This species is aquatic during the larval and pupal stages. The life cycle is divided into the following four distinct stages: (1) egg, (2) larvae consisting of 4 instars, (3) pupae, and (4) adult. After mating the female adult midge oviposits a single egg mass directly into the water. Each egg mass contains approximately 2,300 eggs that will hatch in 2 to 4 days depending on environmental conditions. The entire life cycle takes about 24 days (U.S. EPA 1994).

After hatching, the larvae begin to build tubes in which they will feed. The larvae generally draw small food particles into their tubes for feeding, but may also feed outside their tubes. The four larval stages are followed by an intermediate pupal stage and finally by an ephemeral adult stage. Adults mate during flight immediately after emergence (U.S. EPA 1994).

Exposure Profile (*Chironomus tentans*)

Since direct contact with and ingestion of contaminated sediment are the primary routes of exposure for *Chironomus tentans* in the toxicity test, the results of this test were used to indicate both routes of exposure in the risk assessment.

E.2 *Hyaella azteca*

Life History (*Hyaella azteca*)

The amphipod, *Hyaella azteca*, is commonly found in freshwater lakes, streams, ponds, and rivers throughout North and South America. In preferred habitats, they are known to reach densities in excess of 10,000 per square meter. They may also be found in sloughs, marshes, and ditches, but generally in lower numbers (U.S. EPA 1994).

Hyaella azteca are epibenthic detritivores that feed on coarse particulate organic material. They typically burrow into surface sediment, and avoid bright light. Because of their feeding and behavioral characteristics, they are ideal test organisms for toxicological evaluation of freshwater sediments. Avoidance of light by movement into the sediment keeps these organisms almost constantly in contact with sediment contaminants (U.S. EPA 1994).

Reproduction in this crustacean is sexual. Males are larger than females and have larger front gnathopods that are presumably used for holding the female during amplexus and copulation. During amplexus, the male and female feed together for a period of up to one week. The pair separates temporarily while the female goes through a molting period. Immediately after the molt, the two rejoin and copulation begins. During copulation, the male releases sperm near the female's marsupium. The female sweeps the sperm into her marsupium, and simultaneously releases eggs from her oviducts into the marsupium where

fertilization takes place. The average brood size for female *Hyaella azteca* is 18 eggs per brood, but this number can vary with environmental conditions and physiological stress (U.S. EPA 1994).

Developing embryos and hatched young are kept inside the female's marsupium until she undergoes a second molt. At that time, the juvenile *Hyaella azteca* are released into the surrounding environment. Under favorable conditions, each female produces approximately one brood during every 10-day time period (U.S. EPA 1994).

Hyaella have a minimum of 9 instars, with 5 to 8 pre-reproductive stages. The first five stages are juvenile stages; instars 6 and 7 form the adolescent stages; and stages 8 and higher are considered adult (fully reproductive) stages (U.S. EPA 1994).

Exposure Profile for *Hyaella azteca*

Since direct contact with and ingestion of contaminated sediment are the primary routes of exposure for *Hyaella azteca* in the toxicity test, the results of this test were used to indicate both routes of exposure in the risk assessment.

E.3 American Robin (*Turdus migratorius*)

Life History of the American Robin (*Turdus migratorius*)

The American robin (*Turdus migratorius*) occurs throughout most of the continental United States and Canada, wintering in the southern half of the United States, Mexico, and Central America. Given the increase in open habitat and lawns, the robin's breeding range has expanded in recent times. Habitat requirements for breeding robins include access to fresh water, protected nesting sites, and productive foraging areas. These requirements are commonly met in moist forests, swamps, open woodlands, and other open areas. Non-breeding robins occupy similar habitats although proximity to fruit bearing trees is of more importance.

The primary foraging technique for robins is to hop along the ground in search of ground-dwelling invertebrates, although they commonly search for insects and fruit in tree branches as well. The diet of the American robin consists of seasonally variable proportions of invertebrates (e.g., earthworms, snails, beetles, caterpillars, spiders) and fruit (e.g., dogwood, cherry, sumac, hackberries, raspberries) (U.S. EPA 1993; Ehrlich *et al.* 1988). During spring, summer, and fall, the dietary composition is reported to change from 93 percent invertebrates and 7 percent fruit in the spring (nesting season) to 92 percent fruit and 8 percent invertebrates in the fall (migratory season). The summer dietary proportion is reported as 68 percent fruit and 32 percent invertebrates (U.S. EPA 1993).

Breeding territories are established by male robins. Most foraging occurs close to these territories during the breeding season; however, if densities of robins are high in a given area or if food resources are limited, adult robins will leave to temporarily forage elsewhere. Outside of the breeding period, robins typically return to the same foraging sites and roost within 1 to 3 kilometers (km) of these areas (U.S. EPA 1993).

Exposure Profile of the American Robin (*Turdus migratorius*)

Adult American robins are reported to weigh from 77.3 to 133.8 grams (g) (U.S. EPA 1993). Territory sizes vary from 0.3 to 1 acre, with foraging home ranges reported up to 2 acres (U.S. EPA 1993). The lowest reported body weight (77.3 g) and the smallest reported home range (0.3 acres) were assumed for this study. Therefore, it was assumed that an American robin could obtain 100 percent of its diet from the contaminated area (area use factor of 1), since the area comprising the on-site terrestrial sampling locations was greater than 0.3 acres.

An average adult robin can consume 8.7 grams of food per day (Levey and Karasov 1989). An incidental soil ingestion rate for the American robin could not be found in the literature. However, a soil ingestion rate of 10.4 percent of the diet reported for the American woodcock will be used as a substitute ingestion rate for the American robin (Beyer et al. 1994). Assuming a food ingestion rate of 8.7 g/day, the soil ingestion rate for the American robin is 0.9 g/day.

Since earthworms comprise a large portion of the American robin's diet, and since contaminant concentration data are available for earthworms from the earthworm toxicity and bioaccumulation assay, it was assumed that 100 percent of the diet of the American robin was comprised of earthworms for the purposes of the food chain model in this study.

E.4 Short-tailed Shrew (*Blarina brevicauda*)

Life History of the Short-tailed Shrew (*Blarina brevicauda*)

The short-tailed shrew is an extremely active, large, and heavy-bodied shrew common within its range (Jones and Birney 1988). It occupies a variety of moist and dry habitats such as marshes, bogs, moist forest floors with ample decaying matter, brushland, fencerows, weedfields, and pastures (Barbour and Davis 1974; Jones and Birney 1988). Short-tailed shrews are active both day and night throughout the year, although most of this activity is subnivean (Merritt 1987). During harsh winters, this species may undergo a period of torpor (Hoffmeister 1989).

The home range of this species varies with their dramatic population cycles. In peak years, animal density may be greater than 25 individuals per acre (Schwartz and Schwartz 1981). In other years, this species may have an animal density of one individual per acre (Merritt 1987).

Although short-tailed shrews strongly prefer animal matter, they are opportunistic omnivores and will voraciously consume whatever food items are in ample supply (Barbour and Davis 1974). These food items include earthworms, slugs, snails, insects, arthropods, fungi, vegetable matter, seeds, snakes, salamanders, small mammals, and young birds (Barbour and Davis 1974; Jones and Birney 1988; Schwartz and Schwartz 1981). Plant matter is generally consumed to a greater extent in winter (Schwartz and Schwartz 1981). In some regions, plant matter may constitute up to 20 percent of the shrew's diet (Barbour and Davis 1974). Submaxillary glands produce a venom that quickly immobilizes their prey (Merritt 1987). Prey items that are not consumed immediately are stored in a cache (Merritt 1987).

Using echolocation and scent-marking, short-tailed shrew rely heavily on their hearing and sense of smell to locate food and to move about (Hoffmeister 1989). An elaborate system of runways and tunnels are constructed usually just a few inches below the ground surface (Schwartz and Schwartz 1981). Two types of nests are built by this species, a breeding nest and a resting nest. Both nests are built underground beneath a log, rock, or other cover, and have multiple entrances. The breeding nest is typically larger than the resting nest (Merritt 1987).

Breeding appears to commence in early spring and extend into the fall, although in some regions, breeding may subside in early and midsummer but peak again in early fall (Hoffmeister 1989; Jones and Birney 1988). Gestation periods are approximately 21 to 22 days with litter sizes of approximately four to ten young (Jones and Birney 1988; Schwartz and Schwartz 1981). The young are fully mature from one to three months of age (Barbour and Davis 1974; Schwartz and Schwartz 1981). Both sexes may breed their first spring (Schwartz and Schwartz 1981).

Natural predators of the short-tailed shrew include fish, snakes, owls, hawks, shrikes, opossums, raccoons, foxes, weasels, bobcats, skunks, and feral cats, although most of these predators do not consume the shrew (or at least all of the shrew) because of their distasteful musk glands (Barbour and Davis 1974; Jones and

Birney 1988; Merritt 1987; Schwartz and Schwartz 1981). The life expectancy of a short-tailed shrew in the wild is approximately one year (Schwartz and Schwartz 1981).

Exposure Profile of the Short-tailed Shrew (*Blarina brevicauda*)

Adult short-tailed shrews weigh from 12 to 30 grams (g) (Jones and Birney 1988; Merritt 1987). Home ranges vary from 0.5 to 1 acre (Merritt 1987). Therefore, it was assumed that a short-tailed shrew could obtain 100 percent of its diet from the contaminated area (area use factor of 1), since the area comprising the on-site terrestrial sampling locations was greater than one acre.

Food ingestion rates ranging from 0.49 to 0.62 gram per gram of body weight per day (g/g BW/day) have been reported (U.S. EPA 1993). An average food ingestion rate of 7.95 g/day has also been reported (U.S. EPA 1993). To express the former food ingestion rates in units of g/day for comparison to the latter ingestion rate, the former ingestion rates were multiplied by the lowest reported body weight of 12 grams to yield food ingestion rates of 5.88 to 7.44 g/day. Of these values, the highest food ingestion rate of 7.95 g/day will be used for the purposes of this study.

A soil ingestion rate for the short-tailed shrew was not available from the literature. Therefore, the soil ingestion rate of the American woodcock (*Scolopax minor*) was used. The American woodcock's diet and feeding patterns are similar to those of the short-tailed shrew since they are both opportunistic omnivores that consume earthworms and other soil invertebrates (U.S. EPA 1993). A soil ingestion rate of 30.1 percent of the diet was reported for the American woodcock (U.S. EPA 1993). This value was multiplied by the highest food ingestion rate of the short-tailed shrew (7.95 g/day) to yield a soil ingestion rate of 2.46 g/day.

Since earthworms comprise a large portion of the short-tailed shrew's diet, and since contaminant concentration data are available for earthworms from the earthworm toxicity and bioaccumulation assay, it was assumed that 100 percent of the diet of the short-tailed shrew was comprised of earthworms for the purposes of the food chain model in this study.

REFERENCES

- Barbour, R.W. and W.H. Davis. 1974. *Mammals of Kentucky*. Lexington, KY: University of Kentucky Press. 322p.
- Beyer, W.N., E.E. Conner, and S. Gerould. 1994. "Estimates of Soil Ingestion by Wildlife." *J. Wildl. Manage.*, 58(2):375-382.
- Ehlich *et al.* 1988. [full citation missing]
- Hoffmeister, D.F. 1989. *Mammals of Illinois*. Urbana, IL: University of Illinois Press. 348p.
- Jones, Jr., J.K.J. and E.C. Birney. 1988. *Handbook of Mammals of the North Central States*. Minneapolis, MN: University of Minnesota Press. 346p.
- Levey, D.J. and W.H. Karasov. 1989. Digestive responses of temperate birds switched to fruit or insect diets. *Auk*, 106:675-686.
- Merritt, J.F. 1987. *Guide to the Mammals of Pennsylvania*. Pittsburgh, PA: University of Pittsburgh Press. 408p.
- Schwartz, C.W. and E.R. Schwartz. 1981. *The Wild Mammals of Missouri, Revised Edition*. Columbia, MO: University of Missouri Press and Missouri Dept. Conserv. 356p.

U.S. EPA. 1993. "Wildlife Exposure Factors Handbook, Volume I of II." United States Environmental Protection Agency, Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.

U.S. EPA. 1994. "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates." United States Environmental Protection Agency, Office of Research and Development, Washington, D.C. EPA/600/R-94/024.